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JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania;

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

EDITED
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JANUARY, 1831.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN OCTOBER, 1830.

With Remarks and Exemplifications, by the Editor.

[Concluded from page 376 of vol. vi.]

44. For an improved *Smut Machine,* for hulling, smutting, and cleaning grain; Jeremiah Cose, Sodus, Wayne county, New York, October 1.

The grain to be cleaned by this machine is, in the first instance, made to fall from the shoe of the hopper into a riddle, and thence into a smut wheel, which is a wheel of fifteen inches in diameter, and three inches deep; this wheel has an eye of six inches diameter, made like that of a mill stone. The smut wheel is furnished on the under side with a sheet iron grater, or with points of iron, and runs upon a circular bed of sheet iron of the same diameter, and perforated with small holes. The grain passes between the scouring wheel and bed, and runs over eight small screens within the curb inclosing the wheel; thence it falls by a small opening through an air channel, into the eye of the stone. In its passage it is acted upon by an air wheel, or fan, to which the requisite motion is to be given, as well as to the smut, or scouring wheel.

There is no claim to any part of the machine.

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45. For an improvement in the *Making of Pepper and Ink Tops;* William Markland, City of New York, October 1.

This patent is taken for raising the tops of ink stands, or pepper

boxes, out of one piece of metal, instead of by soldering, or grooving two pieces together. The raising is to be effected in any of the presses commonly used for such purposes, and we are informed that the tops may be ornamented, by means of beading rollers, which beading rollers consist of a male and female roller, between which the raised tops may be placed, and the bead, or other ornament raised upon them.

The claim is to "the making or manufacturing of *pepper* and *ink tops*, from one entire piece."

It is possible that the making of pepper and ink tops in this way, may not have been practised, but tops for canes, and many similar articles, have been so made. There is nothing new in giving to metal the form proposed, by the means pointed out in the specification, nor is it pretended that such is the case; the patent, therefore, must rest upon the exclusive application of the raised metal, to pepper and ink tops.

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46. For a *Thrashing Machine;* William Ottinger, Whitemarsh, Montgomery county, Pennsylvania, October 1.

We think it unnecessary to describe this machine, as it wears the uniform of the regiment to which it belongs, and if there is any difference in its accoutrements, these are not specified in its commission. The whole machine, with its cylinder, beaters, and hollow segment, is described, but no claim made.

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47. For an improvement in the *Construction of Hair Mattresses;* William F. Phyfe, City of New York, October 1.

These mattresses are to be stuffed with three or more distinct layers of hair, between which canvass extends from side to side, and is secured to the ticking which forms the borders of the mattress. The specification contains directions for stuffing the mattresses between the different cloths, and the manner of tying the strings which are to retain the stuffing in its proper place.

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48. For a *Rotary Steam Engine;* Thomas Powell, Baltimore, Maryland, October 1.

Instead of being for a rotary engine, as stated in the petition and specification, the patent is taken for dispensing with the crank in the ordinary reciprocating engine. The mode in which this is proposed to be done, is altogether without the recommendation of novelty. A rack upon the piston rod, is to work into cog wheels furnished with ratchets, in a way familiar to every one acquainted with the history of the abortive attempts which have been made to improve the steam engine.

The patentee informs us that "this engine *promises* to supersede all others, for simplicity of construction; for power obtained by a full action of the steam on the extreme periphery of the wheel; for power saved by reducing the friction, caused by the machinery ne-

cessary to keep up the action of the crank; for *gaining the loss of power* in the crank approaching to, and receding from, the dead points; and for doing away a large body of machinery, thereby simplifying the machine, and greatly reducing the expense."

We are of opinion that this promising machine will not falsify the old adage, that "quick promisers are slow performers." The same kind of machinery has made precisely the same promises to a large number of previous projectors, and has never yet redeemed its word. We, who know this, have no confidence in it on the present occasion.

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49. For a machine for *Drilling Rocks for Blasting;* John W. Post, Washington City, October 1.

This machine consists of the drill ordinarily used for the purpose of drilling rocks, but it is to be supported by a frame, standing upon four legs. It is to slide up and down through holes in the cross bars of this frame. The drill is attached to a double bow spring, at its upper part, and is to be loaded with a weight, should its own weight be too small. The drill is to be forced down by the hand in the usual way, and raised by the elasticity of the spring. The claim of the patentee is to "the use of the spring, constructed as above described, and the form of the rod, and its connexion with the spring; or whatever may prove to be original or novel, in the above description."

It is no uncommon error on the part of patentees, to suppose that after they have claimed certain specific things, they have a contingent remainder in certain others which may hereafter prove to be new: but who is to find out the novelty, if the inventor cannot? It is his business to inscribe *nole me tangere* on the part which he patents, and if he cannot tell where to place the label, he may rest assured that others have no interest in making the discovery.

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50. For a *Machine for Cutting Straw;* Titus Preston, Wallingford, New Haven county, Connecticut, October 1.

The description of this machine is of considerable length, entering into a minute description of all its parts, both new and old. Its general structure is similar to many long known straw cutters. The specification ends as follows.

"I do not, however, claim the whole machine herein described, as my invention. But I do claim as my invention and improvement, the feeding box, and its appendages, particularly the rack and screw wheel, as above described. The gate with its several appendages, and the mode herein described for fastening the plank upon the shaft; and the screws to regulate the knife. And for these, jointly and severally, I claim an exclusive right."

The cutter is a curved revolving knife, fastened to a plank by means of screws, with check screws to set it at the proper distance from the plank. The mode of doing this, it will be seen, is claimed; this mode, however, is well known to every machinist. The straw is drawn forward by an endless screw cut upon the back end of the

shaft upon which the revolving knife is fixed. This screw takes into a rack on the bottom of a feeding box; and the straw is thus regularly drawn forward by the revolution of the knife.

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51. For a machine for *Propelling Vessels through the Water;* Felix Peltier, City of New York, October 1.

The oft patented, and still oftener proposed screw, is here again brought forward for the purpose of propelling vessels through the water. The patentee says, "I make use for the propulsion of vessels, of a screw placed in a horizontal position, and wholly uncovered, or naked; that is to say, not working into a nut, or female screw, but enveloped wholly in water, which answers in respect to it, the same purpose as the female screw in the ordinary applications of that mechanic power, to the mechanics of solid bodies. And for the purpose to which I propose its application, I declare that every possible form or modification of the screw is adapted to the purpose, excepting the screw of Archimedes, in which the water passes through a hollow spiral channel. I therefore claim as forming a part of my invention, the right of using, for the propulsion of vessels, every form of the naked, or uncovered screw, whether it be formed of a single spiral wound round a solid arbor, and cutting it constantly at equal angles, or whether its inclination vary, and whether the spiral be of one and the same breadth throughout, or vary in its several dimensions measured from the arbor," &c. &c. &c. &c.

We have been so frequently called upon to pronounce upon the foregoing *new* invention, that to give an opinion upon its merits, would be merely to repeat what those who read our pages already know.

The present patentee is, we apprehend, secure in one point, and a very important one, namely, that of the many who have already tried his plan, not one will take him into court for evading their rights. To numbers of them the project has already proved as expensive and as profitless as is usually the case with a suit at law.

---

52. For a *Machine for Raising Water;* Luman Parmelee, Poughkepsie, Dutchess county, New York, October 1.

The mode of raising water here patented, is very similar to that described at page 305 of the last volume; it also resembles several others patented both here and in England. It has no claim to novelty, and does not prefer any, for it places the whole machine before us, as though such an one had never been thought of before.

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53. For *Machinery for Manufacturing Cotton Twine,* and other small cordage, at one operation; Thomas Rice, Petersburg, Dinwiddie county, Virginia, October 1.

In this machinery, there are separate bobbins for twisting and for laying. For four strand twine there are four of the former, to three

of the latter, and so of any other number. The twisting bobbins are placed at one end of a frame, and the laying bobbins at the other. From the flyers of the twisting bobbins the yarn passes up through guides, to a roller, and after passing over this, it is conducted down to the laying bobbin beneath it. In passing over this roller down to the flyer of the laying bobbin, the strands are kept from riding, by passing separately through holes, or notches in brass plates. The claim is as follows.

"What I claim as my invention and improvement, is the application of the twisting spindles to this use; also the roller that draws the strands from the bobbins on the twisting spindles, regularly, as they are twisted. Also the two guides, one on the back of the roller, the other under the roller."

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54. For a mode of *Preventing Explosions in the Boilers of Steam Engines;* A. B. Quinby, Hagerstown, Washington county, Maryland, October 1.

(See specification.)

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55. For a machine for *Ornamenting Columns for Cabinet Makers,* carpenters, chair makers, turners in wood, metal, ivory and marble; Robert Thompson, Washington, Guernsey county, Ohio, October 1.

The machinery for which this patent is taken, bears a very near resemblance to several other machines, patented and unpatented, which have been used for a similar purpose. A frame is made to receive the post or column to be reeded or fluted, and a stock, like a plane stock, is carried backward and forward, being guided by the sides of the frame. Bits of different forms and kinds are fitted into the stock; a dividing plate regulates the arrangement of the flutes, reeds, &c. A mandrel furnished with spiral or other fillets, serves, by the motion of the stock, to turn the column round, as it receives the intended ornament.

"The invention here claimed is the before described mode of ornamenting all kinds of columns, in wood, &c. by means of a mandrel containing filleting, with the various adjusting stocks, and the machinery described for that purpose."

A claim so vague and general, affords no intimation whatever of the thing intended to be patented, unless the whole arrangement were new; but in cases like the present, where the novelty is questionable in nearly all the separate parts, the patentee ought to specify particularly in what his invention consists.

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56. For an improvement in the *Action of the Upright Piano Forte;* Jesse Thompson, City of New York, October 1.

The claim attached to the specification will give, to those acquainted with the subject, a general idea of the variations introduced in this action.

"What I claim as new, and as my own invention, is,"

"First, the application of the finger lever directly to the foot of the connecting rod, dispensing with the jack, springs, and all intermediate gearing. By this more immediate operation of the finger lever on the hammer, no time is lost between the touch and the blow; the action is more controllable by the finger; the blow is quicker and more powerful; the hammer can never block; it relieves less from the string; and requires much less depth of touch. The simplicity of its construction renders the work much cheaper, and less liable to get out of order than any known action."

"From this perfection of the action I have been able to render the span of the natural action to six and a half inches, and the others in proportion, without in any degree interfering with a clear and rapid execution. Or the common span of the octave may be retained."

"Second, the placing the dampers below the hammer rail, by which position the dampers fall on the brass strings nearer the middle of them, and thus more instantaneously and effectually stop their vibration, and may be raised by the simpler and cheaper modes herein before specified."

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57. For *Manufacturing Hat Bodies by Machinery;* Henry Tenny, Plattsburgh, Clinton county, New York, October 1.

This is another variation of the machines for forming hat bodies from a fleece taken directly from the carding machine. The wool is received, as in others, on a revolving apron, passed round rollers. The principal difference between it and some others, is, that the revolving apron passes over a roller which is large at each end, and small in the middle, just the reverse of the double conical formers upon which the wool is to be eventually rolled. The apron is made sufficiently loose to swag, so as to pass into the hollow of the concave roller. Behind this roller the double conical former is laid upon the apron, and as this moves round the hat former receives a wabbling motion, crossing the wool in the way required.

We are told that this is an improvement, but in what part of the arrangements the improvement consists, no information is given. Many parts of the machinery resemble others used for the same purpose; the portion which is new may probably be valuable, but the fatal and common error of not pointing it out, is again committed.

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58. For *Preparing Clay for Making Brick;* Jared G. Falcott, Glastonburgh, Hartford county, Connecticut, October 1. (See specification.)

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59. For a *Double Dasher Churn;* William Sutton, Geneva, Ontario county, New York, October 1.

This is a new patent for an old machine, which we have more than once had occasion to describe. Two vertical shafts are made to revolve, each carrying dashers, which pass in the spaces between

the dashers of its fellow. The whole is clearly represented in the drawing, but there is no claim.

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60. For a *Machine for the Purpose of Raising Water and Acquiring Power;* Theophilus Somerby, Nantucket, Massachusetts, October 1.

To any one having the slightest claim to the name of machinist, or to any one acquainted with the elementary principles of motion, no more need be said, than that the plan proposed is to raise water by the action of the tide or current upon a small float wheel. The water is to be raised in buckets, similar to the hopper boys, used in flour mills; which water is afterwards to be employed in driving machinery.

The patentee probably expects to cheat the water out of a portion of its gravity, by coaxing it up an inclined plane, instead of raising it vertically. Should he succeed in doing this, there will be something new in his *invention.* We dare not add useful, because we are not quite certain that we should derive any advantage from abrogating the laws of nature.

---

61. For *Machinery for Boring and Mortising;* Marcellus Sands, Franklin, Delaware county, New York, October 1.

This machinery is intended for boring and mortising hubs, and other articles. It is well represented and described in the drawing and specification. There is no claim made, and as the arrangement of the parts differ considerably from the machines previously patented for similar purposes, it is probably considered that the whole is new. Without the drawing, a description would not be intelligible.

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62. For a *Baking Iron, for the purpose of Baking, Toasting, or Boiling;* Elijah Skinner, Sandwich, Strafford, county, New Hampshire, October 1.

This is an affair made of sheet iron, and in form something like a cheese toaster. Its principal merit and *novelty* consists in its being more cheaply made than a tin kitchen. "What I consider as new," says the patentee, "and my own invention, is the construction of the instrument as described in the specification, cheap, and easy made, varying from a tin kitchen and boiler, so that one cheap instrument may supply the place of a cake block, toast iron, gridiron, and broiler."

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63. For a *Thrashing and Winnowing Machine;* Samuel Slater, Northern Liberties, Philadelphia county, Pennsylvania, October 1.

We will let the patentee tell for himself the improvements which he has made. After describing his machine, which we should be in danger of confounding with some others, he says, "the difference

between the plan and operation of this thrashing and winnowing, or cleaning machine, consists in this, that is to say; in the first place, the machine is constructed with a board flooring instead of a cloth apron, which is now used. The board flooring answers the purpose much better than the revolving apron, and is at the same time less expensive, and not liable to want repairing; or to being injured. 2nd. The beater revolving or throwing the dust from the person attending the machine, which is not the case in any former invention. 3d. The simplicity of the concave. 4th. The fan, the wind coming in contact with the beater, which prevents the straw from tangling. 5th. The whole machine is more simple, and precise in its operations, much better calculated for the farmer than any now in use, durable, and easily constructed, the price considerably less than others, which afford no competition with the above described. 6th. The machine is also admirably calculated for thrashing rice."

The foregoing novelties, are some of them old, and others intangible. The board flooring has been long and frequently employed. The beater throwing the dust from the person has been used in former machines. With respect to the cheapness, and other desirable properties of that kind, we have nothing to say, and will only add a curious kind of claim, which also belongs to the intangibles, "*the claims are the general merits of the machine.*"

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64. For a *Mode of Straightening the Splits or Dents for Weavers' Reeds*, by the application of heat; Jacob Senneff, City of Philadelphia, October 1.

(See specification.)

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65. For a *Thrashing Machine;* William Sperry, City of New York, October 1.

A cylinder and concave segment are to perform the work of thrashing. The cylinder is to be made of one solid piece of timber, driven full of flat spikes. These are to project about one inch from the wood, and to stand "diagonally each way." The concave segment is to be formed of any number of *slabs*, fluted lengthwise.

These are the particulars claimed; but we do not know by which of these features it is distinguished from other thrashing machines.

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66. For a mode of *Applying Power for Propelling Thrashing Machines*, turning lathes, furnaces, cider mills, or any such machinery; Augustus Sawyer, Hopewell, Ontario county, New York, October 1.

This is one of those contrivances in which, by multiplying the moving parts of a machine, those who have no solid knowledge of mechanics succeed in cheating themselves and others into a belief that they have made a discovery.

A horse is to turn a shaft, carrying a horizontal wheel, in the manner of the common horse mill. The cogs of this large wheel are to

mash into a trundle head; on the shaft of this trundle head there is to be a horizontal screw, of wood or metal. The threads of this endless screw are to turn a perpendicular cog wheel: on the shaft of this is to be another cog wheel; this last wheel is to turn "a large band wheel, which by means of a band attached, plies a small wheel with a great increase of *velocity*. To the axle of this latter is attached the machine necessary to be put in motion."

We have no doubt that this machinery will be as useful in "propelling furnaces," as in its application to any other purpose.

---

67. For an improvement in the *Carding Machine;* Uriel Warner, Ripley, Brown county, Ohio, October 1.

We do not very well understand the description of this improvement. The object is to work the comb, in the operation of doffing, by a new arrangement of the parts which give it motion. This it is said to do more steadily, and with less power than the common method.

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68. For an improved *Water Wheel for Propelling Mills;* Clark Willson, Swanzey, Cheshire county, New Hampshire, October 1.

A vertical shaft is to be supported by suitable gudgeons. At the lower end of this shaft, there are bucket boards of wood, or other material, which bucket boards are let into the shaft, and are surrounded by a rim. Some idea of the form of this wheel may be obtained, by supposing the leaves of a smoke jack wheel to have a rim extending from face to face. On the upper face of the wheel the buckets have less inclination than at a distance from it, and are so curved, that on the lower side, where the water makes its exit, they are nearly horizontal. "The application of the water to the wheel may be by placing the wheel in the base of the floom, and giving the bulk of water free access to drop into and vent from the spiracles."

"The advantages of this wheel are the saving of a large portion of water; the omission in most instances of gearings in mills, &c.; the cheapness of building and repairing, and the free and uninterrupted operation of the wheel in flood water," &c. &c.

The mode of applying this wheel is very imperfectly described, the whole of the directions being comprised in the part above quoted. The claim is to "the particular form of the spiracles, [buckets,] or ventways, and the manner of applying the water to them."

---

69. For a machine for *Thrashing Grain;* William J. Wood, Batavia, Genesee county, New York, October 1.

We opened the specification of this patent with the expectation of seeing another cylinder, and hollow segment, but found a machine new in its form, whether superior or not in its operation, we are not prepared to say.

Suppose a wheel, with spokes, like a coach wheel, and another of

only a few inches in diameter, to be connected together by an axis. These wheels, if rolled round on a floor, would pass round a point, in the manner of a cone. From the barn floor, on which the grain is to be thrashed, rises a vertical shaft, to which the axis is attached, at the end bearing the small wheel, or at the apex of the supposed cone. To a sweep from this shaft a horse may be attached, and the machine drawn round. The flails are formed of plank, and are as numerous as the spokes of the wheel, which in the drawing amount to 18. They rest against the spokes by their flat sides, their edges standing towards the rim and hub; they extend from wheel to wheel, being attached to the smaller wheel by pins, or otherwise, forming a moveable joint upon which they play. At the other end they are kept in their places by the rim and spokes of the large wheel. The levers, or flails on the upper side of the machine, rest upon the hub, but fall by their gravity, as it rolls round, and strike upon the wheat, or other grain upon the floor. The claim is to the application of power in this way, for the purpose of thrashing.

We should be apprehensive that these flails would not fall upon the straw with sufficient force, or directness, to accomplish the purpose intended.

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70. For an improvement in the *Construction of Saw Mills;* Joseph Newton, Sweden, Monroe county, New York, October 1.

The improvement proposed, is, to have teeth on both edges of a saw, and to construct the mill in such a manner that the log may be sawed in passing either way. There are to be two rag wheels, and two feed hands, operating in reversed directions.

We much doubt whether the advantages derived from this mode, in ordinary sawing, will compensate for its inconveniences. The plank must be cut entirely off, whilst in the ordinary mill they support each other until the last slab is taken off. If any mode of obviating this objection has been devised, it has not been presented to us by the patentee.

---

71. For a *Hinge and Plain Stock*, for gentlemen's wear; Denison Williams, Albany, New York, October 1.

" Said improvement consists in making the hinge stock of different descriptions of fur and of hair seal skins, with an approved and new composition foundation consisting of hair or bristles, or either of them, supported by prepared elastic linen."

There is no drawing of the proposed stock, and the foregoing is the whole description; and if it is given "in full, clear, and exact terms," we know not what is deficient, obscure, and indefinite.

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72. For a *Machine for Cleaning Grain;* Michael Urffer, Upper Milford, Lehigh county, Pennsylvania, October 1.

The general form of this instrument is that of the Dutch wheat fan. Instead of the ordinary screens, or sieves, there is a cylindrical

revolving sifter, working something like a bolter, the grain passing in at one end, and out of the other, on to the inclined board, where the fan operates upon it. This is the principal alteration from the common arrangement.

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73. For an improvement in the *Hemp and Flax Dresser;* Ethan H. Nichols, of Hardwick, and Thaddeus Fairbanks, of St. Johnsbury, Caledonia county, Vermont, October 1.

The machine used is that constructed by Hines and Baine, and the improvement claimed is for pairs of rollers to be used with it, which the patentees call *dressers.*

These rollers have iron beaters extending from end to end, like the cogs of wheels; they are placed in pairs, with the leaves of one roller mashing between those of the corresponding roller.

This plan bears a very near resemblance to others which we have formerly noticed.

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74. For a *Churn,* called the "Float Wheel Churn;" Ebenezer Deevey, Butternuts, Otsego county, New York, October 1.

This is a sort of barrel churn, with an axis passing through it, having dashers placed upon it obliquely, and in reversed directions.

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75. For an improved *System of Procedure in the Drying and Curing of Tobacco;* Davis G. Tuck, M. D. Halifax Court House, Virginia, October 1.

The system proposed is founded upon the principle, that in order to preserve the valuable qualities of vegetable substances, which are to be desiccated, the process ought to be effected within a limited time, in order to prevent spontaneous decomposition; and that to effect this, the operation must be carried on at temperatures within the absolute control of the operator. The whole arrangement proposed by the patentee, is sufficiently simple to be carried into effect by ordinary hands; the principles upon which it is based, are obviously true, and the test of actual experiment has evinced its great value. We shall hereafter give an epitome of the specification, which is of considerable length.

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76. For *Wire Eyed Cast Buttons;* T. Festus Hayden, Waterbury, New Haven county, Connecticut, October 1.

The following is the substantive part of the specification.

"The wire eyed cast buttons for coat, vest, or other use, is made, stamped according to fancy, burnished and edged in the usual manner, and fitted to receive the cap, or shell, or rim required, which is prepared from the same materials, and put on and closed down in the same manner as is usually done on buttons with soldered eyes. "The wire eyed *cast* buttons may be prepared for inlaid work by an indentation in the face by a suitable stamp or die; or by a

projection in the face of the mould, or by raising the edge by passing through dies calculated for that object: when thus prepared, any fancy work of brass, or other ornamental metal, may be inserted and fixed in its place by the burnisher, or by a stamp with ornamental devices impressed upon the raised edge."

"I do not claim as my invention the method of making the wire eyed *cast* button. This has long been known and used: nor do I claim as any part of my invention, the method of making or preparing the cap, shell, rim, inlaid, or other ornamental work, attached to the face of other buttons as now known and used; but I do claim as my invention and improvement, the application thereof to the wire eyed *cast* button as above described."

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77. For an improvement in the art of *Manufacturing Malleable Iron from Pig Metal;* Thomas Cotton Lewis, Pine Creek, Alleghany county, Pennsylvania, October 1.

(See specification.)

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78. For *A Cylindrical Grate Cotton Whipper;* James S. Simmons, Scituate, Providence county, Rhode Island, October 1.

This cotton whipper consists of a cylindrical grate placed vertically, and inclosed in a wooden box. A shaft passes down through the centre of the cylindrical grate. Arms project from this vertical shaft, and others called fingers, project from the interior of the cylinder, in such a manner, that when the shaft is made to revolve, its projecting arms may pass between those on the cylinder.

The cotton is fed into the cylinder, where, by the rapid motion of the shaft, it is beaten and opened; the seeds and other foreign matter being principally driven out through the grating of the cylinder. There is, of course, a suitable opening for the delivery of the cotton.

The claim is to the cylindrical grate; to the fingers inserted within the grate, or cylinder; and to the shaft passing through the cylinder, and having two, three, or more arms inserted in it.

---

79. For an improvement in the *Mode of Manufacturing Combs;* James Pitts and Cyrus Houghton, of Lancaster, Worcester county, Massachusetts, and Joseph Rice, Jr. of Scituate, Rhode Island, October 1.

This patent is for "a machine for grinding comb stocks, and making combs."

"This improvement consists in several things. *First,* in grinding or preparing the stock for combs, doing that part of the work by machinery, which hitherto has usually been done by hand. *Second,* in a better method for smoothing the teeth from the back, or quill of the comb, to the end of the teeth. *Third,* in a better method of pointing, or rounding the teeth."

A common coarse grit grindstone is used to reduce the horn, &c. to a proper surface, there being under the stone a suitable support

and slide to hold and manage the pieces to be so ground; water is to be allowed to run upon the stone during the operation.

The ends of the teeth, and the rough ends of cut combs, are also to be smoothed by grinding. A third stone, with grooves on its face, is used to smooth the teeth. The stones in the two latter cases are to be used dry. The claim is to the *process of grinding* in the manufacturing of combs.

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80. For *A Churn;* Samuel M. Parsons and Sereno Dickerman, both of Meriden, New Haven county, Connecticut, October 1.

A very formidable specification introduces us to an acquaintance with this churn. The dimensions of every part is given with great precision, and the final claim is to "the combination of the various parts of the machine in the manner aforesaid, to produce the compound motion, and thereby the result."

The trough to contain the cream is semi-cylindrical; above which there is a shaft, to which the dasher is affixed, and the lever by which it is to be worked; this lever being acted upon by hand, causes the dasher to vibrate in the trough.

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81. For a *Circular Car Receiver;* Jonathan Crane, of the City of Schenectady, New York, October 1.

We are informed that "the utility of the circular car receiver, consists mainly in the facility which it affords in removing the car, or other vehicle, from one rail to the other. It is believed that important advantages will be derived from its use in removing ponderous bodies of earth from hills into vallies, and that it can be applied with great advantage in graduating for rail-roads; and at the termination of rail-ways, in removing the car, or other vehicle, when loaded or empty, from one rail [track] to the other, whether the rail-ways are parallel, or at right angles."

The principal object of the patentee appears to be to aid in the construction of rail-roads, where embankments are to be made. Suppose a double track to be laid along the embankment so far as it is completed; these tracks are to be connected together by means of a semicircular platform, which is placed a little below the level of the rails. A carriage, upon rollers, is adapted to this platform, which carriage is of such a height as just to reach the level of the rails. A lever, or sweep, is attached to this carriage, for the purpose of carrying it round from one track to the other; this it accomplishes by its working on a pin, or fulcrum, placed between the two tracks, and in the centre of the curved platform. A car, bringing earth, is received upon this carriage, and by means of the lever, it may be carried round so as to return by the other track; and a succession of cars may thus be employed, without their interfering with each other. The earth, or other material brought, may be shot down, or unloaded, whilst the car is on the circular platform, or in any required part of its journey.

82. For an improvement in the *Spinning Machine;* William Clark Pultney, Steuben county, New York, October 1.

It is some time since we have had before us any of those domestic spinners, which in former times were made the subject of patents in considerable numbers. The reduced price at which the products of our manufactories are now afforded, renders it doubtful whether machines of this description can be advantageously used in many situations. But few of those which have been patented, have any claim to originality of invention; it is only upon the particular arrangement of the parts, *if upon any thing*, that a claim could be sustained. The machine above named does not possess any novelty which we can perceive; and upon this subject the patentee has not attempted to enlighten us, as he merely describes his machine, of which he has furnished a very indifferent drawing, without claiming any part as his invention.

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83. For sundry improvements in a *Printing Machine,* called a Power Printing Press; Isaac Adams, Boston, Massachusetts, October 4.

We cannot pretend to give any description of this machine, which, in the specification, occupies ten pages, and is accompanied by large and complicated drawings. The points claimed, are, "the combination of stationary fly frames, with points for getting register by, on them, with printing presses."

"The object of these fly frames, is, to enable the person who lays on the paper to point one sheet, while the sheet previously put on is receiving the impression, and by that means save the time which would be lost in waiting for a frisket to come out."

An apparatus for giving a periodical movement to the rollers and friskets, as described in the specification, and the use of what the patentee calls declension levers, are also claimed.

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84. For a *Vibrating Flour and Powder Separating Machine;* Benjamin Culver, Glastonbury, Hartford county, Connecticut, October 6.

This apparatus consists of several sieves placed one over the other, increasing in fineness as they descend. The sieves are to be suspended by leather straps, which allow a vibrating motion to be given to them. The contents of each sieve is to be discharged upon a separate, inclined board, and thus conducted to its proper receptacle. The patentee says, "what I claim as my own invention in the aforesaid machine, is the whole of it as applicable in the manner above specified."

As sifters of the kind above described have been long known and used, in several different manufactories, we are of opinion that the claim to the whole machine is altogether unfounded. It is a principle well established in law, that the taking a known machine, and operating by it upon a material to which it had not been previously

applied, is not an invention, or discovery, such as to entitle any one to an exclusive right.

If the sifting machine was not *invented* by the present patentee, it was no *discovery* that flour and powder, as well as drugs, and other pulverized articles, might be sifted by it.

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85. For an improvement in the *Construction of Saw and Grist Mills;* William Prim, Lebanon, Wilson county, Tennessee, October 6.

The proposed improvement consists in the application of spiral wheels to saw and grist mills. When used for a saw mill, the spiral wheel is to be placed with its axis standing horizontally; the wheel running in a trough, or curb, into one end of which the water enters from a penstock. The pitman is to be attached to a crank on the shaft of the wheel. When used for a grist mill, the shaft is to stand vertically, with the stone placed as in the common tub mill. The claim is to the mode of applying the spiral wheel.

The patentee avers that a wheel of this description may be driven with one-third of the quantity of water necessary to wheels of other constructions. We are of opinion that those wheels with which the spiral wheel has been compared must have been of a very indifferent kind, as we know of no plan much better calculated to lose power than those water wheels which act on the spiral principle.

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86. For an improvement in the *Springs of Carriages, and in the method of attaching the Bodies of Carriages to the Springs;* Joseph Ives and James Walters, Brooklyn, Kings county, New York, October 6.

The springs used by the patentees, are straight springs attached to the perch, or other frame work of the carriage. They extend out in a line with the carriage before and behind, being horizontally, and being bolted down at their inner ends. To their outer ends a rope, chain, or band, is attached, which rises up, and passes over a pulley, to which the other end of the rope, chain, or band, is fastened. The pulley is fixed upon a shaft, the gudgeons of which turn in two standards, framed in the carriage for that purpose. Other pulleys are fixed on the ends of the shaft, from which ropes, chains, or bands extend, and are attached to the body of the carriage.

When the body is hung, its weight tends to turn the pulley, to which it is attached by the ropes or bands, and in doing so the pulley connected with the springs raise them from the frame work on which they rest.

The claim is to this manner of suspending carriages.

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87. For an improvement in the manner of *Constructing Bands for Carriage Hubs;* Samuel K. Miller, Elizabethtown, Essex county, New Jersey, October 7.

The whole description is comprised in the following words.

"The band consists of an iron or copper ring, on to which the beard, cap, or moulding of brass, or other metal or metals is cast, soldered, or fastened by other means. The extent of your petitioner's claim is the iron or copper ring when attached to, or finished with other metal as above described, whereby much greater strength is produced with less weight and bulk than those now in use, of entire brass: on which rests your petitioner's claim."

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88. For *Machinery for Dressing Staves;* William Thomas, Pomfret, Chautauque county, New York, October 7.

The description of this machinery has the same happy brevity with the last mentioned invention: it is as follows.

"The reacting stave dresser consists of two half circles, connected so as to let the stave pass between them, with two or more knives attached to them, so as to dress the stave on the outside and inside at the same time, the knives cutting both ways. The stave is made fast at both ends by dogs, which are attached to a carriage that passes outside of the circles. The semicircle is propelled back and forth by a pitman attached to it from a crank."

By turning to page 77, of the last volume, it will be seen that Mr. Charles B. Goodrich, of Rutland, Massachusetts, obtained a patent, on the 10th of May last, for a machine acting upon the principle above described. Of this machine we thought very favourably; of the originality of inventorship we know nothing.

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89. For a *Locomotive Carriage;* William Heston, Philadelphia, Pennsylvania, October 11.

This locomotive carriage is intended to be propelled by a lever to be worked backwards and forwards by hand, which lever is to operate upon ratchet wheels placed upon one of the axles.

Much stress is laid upon this carriage being worked by *lever power;* and there is evidently an idea entertained by the patentee, that there is some great gain in thus working it. We are informed that "the principle may be applied to the working of all kinds of machinery, and particularly boats, and rail-way cars, by manual or steam power." No doubt it may, but what there is of novelty, or what advantage is to be derived from this particular mode, we are not told, and do not know.

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90. For an *Elevating Bedstead,* for the use of invalids; David Boncroft, Grafton, Windham county, Vermont, October 12.

The upper half of the frame and sacking bottom is made to raise up to any desired angle, by means of pulleys and a rope, which are represented under two or three different modifications, differing but little from former modes of effecting the same object.

Specifications of American Patents.

Specification of a patent for a Self-adjusting Rail-road and Street Car, with Guide Rails adapted to the same. Granted to John Pollock, *of Hopewell, Lower Oxford, Chester county, Pennsylvania, October* 1, 1830.

To all to whom these presents shall come, be it known, that I, John Pollock, of Hopewell, Chester county, Pennsylvania, have invented new and useful improvements in the rail-road and street car, with guide rails adapted to the same. This car I denominate the self-adjusting rail-road and street car, as it is designed to adjust itself to all the ordinary purposes of transportation, on either rail-roads, common roads, or streets, or to turn out from one rail to another, as necessity may require, which objects I effect by the guiding apparatus attached to the fore axle, or bolster of the car, and by placing at the intersection of common, or termination of rail-roads, a simple system of guide rails, which acting simultaneously on the guiding apparatus, attached as aforesaid, enables the car, on leaving the rails, to adjust itself to the common road, or street; or, on leaving the common road, or street, to adjust itself to the rail-road, or turn out, from one rail to another.

Also by a new mode of coupling, the wheels are made to track, or follow each other, in either a straight, or curvilinear direction. By the combined agency of the guiding apparatus and coupling, the use of flanches is avoided. And that the following is a full and exact description of the same, reference being had to the drawings which accompany this specification, and which make part thereof. The bed and wheels may be of the general construction in ordinary use, except that in the mode of guiding and coupling the cars, which I use, (as before observed,) the use of flanches on the common wheels is dispensed with. The peripheries of the wheels are made broad to admit of casual deviations in their motions, or accidental variations in the width of the rails. The axles on which the wheels revolve, are made of iron, and fastened under the lower bolsters which support the bed. In the centre of the hind bolster is a hole in which is a bolt, with a head, or shoulder on which the bed rests. In the centre of the fore bolster is a similar hole with another bolt, or pin, which supports the fore part of the bed. On this bolt is a large broad head, in which are two grooves, or openings, at right angles to each other. The groove parallel with the bolster is to give play, or rocking motion to the bed. The other groove which is parallel with the bed is to admit a horizontal pin which is made fast to the bed, and acts as a pivot on which it may rock, (as above alluded to,) when the wheels are passing over unequal planes. The coupling which I use, may be applied either to a single pair of axles, (as for one car,) or an indefinite number, when many cars are designed to be attached together. It is formed by two rods placed obliquely, and crossing each other in the centre. These rods are connected to

the axles or bolsters, at or near the same, by a joint or pivot on which they turn freely. The rods form tangents of circles, the bolts which support the bed being the centre of the circles. The same radius is used at each end of the coupling, and should be equal to about one-fourth of the length of the axles, inside of, or between the wheels. The joints, or pivots, being placed at the intersections of the radii and tangents.

The rails on which the car is to run may be of either wood or iron, of the common construction, and modes of fixtures, except the guide rails which will be hereafter described. The self-adjusting apparatus for bearing against the sides of the rails, is constructed as follows. There are two levers, or fender rails, (equal in length to about half of the distance between the two main axles,) connected to the fore axle, or bolster, near the wheels, by two short projecting pieces forming pivots for them to work on. The other ends of them project forward, their line of direction forming an angle more or less acute with the plane of the road, on which the car is to travel. They may be connected firmly by cross bars, or braces, or in any other way by which they will have advantage to traverse the axle under the bed, thereby adapting the periphery of the fore wheels to the inclination of the rails. The outer ends of these fender rails, (or guide levers,) are fended from the rails by the interposition of wheels, for the purpose of reducing the friction. These wheels are retained in a horizontal position, as near as possible, (when elevated or depressed,) by attaching them by their axles to the lower ends of upright slings. These slings have in their upper ends an opening, or slit, to admit of their moving up and down on pins, which are attached to the ends of suspending gallows that are made fast to the axle or bolster. The lower ends of the slings are connected to the fender rails by a small axle, or rod, passing through them, on which they have liberty to work. This axle also has two small wheels on it for the purpose of reducing the friction when rolling on the inclined planes of the guide rail, thereby raising or lowering the adjusting apparatus. To secure the adjusting apparatus, either up or down, there are two dogs formed on the principles of the hammer lever; the angles, or fulcrums of which, are connected to the fender rails on one side, by a pivot, on which they work, at a distance from the outer ends of the fender rails, equal to about one-third of their whole length. One end of each hammer lever extends upwards, with a projecting knob on it, for the purpose of catching and holding against the edge of a mortise, or pin, in the suspending arm, or gallows. The other ends of these levers project forward along side of the fender rails, for the purpose of being elevated by the guide rails, or being depressed by their own gravity. The outer extremity of the whole self-adjusting apparatus, as above described, is suspended and retained in its proper position by the bed, on which is a small piece projecting downwards with a slit to receive a slider, which is made fast on the gallows, thereby allowing the lateral movement of the adjusting apparatus; or the same purpose may be effected by a similar contrivance of a slider and gallows on the opposite side of

the fore axle in connexion with the bed, or coupling rods. It will be seen from the above arrangement, that any lateral effect produced on the outer extremity of the self-adjusting apparatus will cause the fore axle to traverse on its centre bolt under the bed, and from thence the motion is communicated by the coupling rods to the hind axle, causing it to move on similar lines and angles to those described by the fore axle. The guide rails, (to answer the purpose before alluded to,) are placed parallel with, and between, the common rails, on a platform which is in the same plane with the common rails. The ends of the guide rails next the intersection of common roads, or streets, are curved, and may meet. Their upper sides are parallel to the plane of the platform, or road, on which they are laid. The other ends form inclined planes on their upper sides, which inclinations extend about half of their lengths, and terminate in an elevation a little above the horizontal ends. There is also a projecting lip, or edge, extending along on the outside of the inclination in the same plane with it, as far as the highest part where the inclination of the lip or edge is reversed.

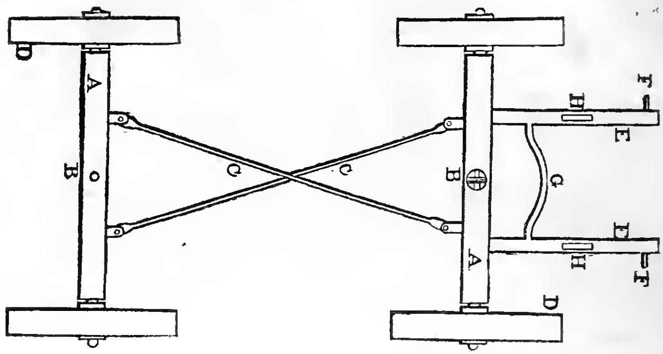
The simultaneous movements of the self-adjusting apparatus, when it is passing off from the rail-road, are accomplished in the following order. The upper ends of the dogs are released from their hold, on the under side of the gallows, by their lower ends ascending the projecting lip, or edge of the guide rail, at the same time the fender levers and wheels are elevated by the inclined plane to their summits, and suspended by the upper ends of the dogs catching on the upper sides of the gallows, as the lower ends descend the reversed inclination on the summit of the lip, or projecting edge of the guide rail. When the car is returning to the rail-road, the fender wheels come first in contact with the horizontal ends of the guide rails, which direct the car on to the rails again, when, by the simultaneous agency of the adjusting apparatus, the fenders are depressed to their former position, by the same causes which effected their elevation. What I claim as new, and my invention or discovery, in the foregoing discovery, is, first, the self-adjusting or guiding apparatus, attached to the fore axle of the car, by which it is made to answer the several purposes hereinbefore described. Second, the tangent coupling or connecting rods, as before described. Third, the guide rails placed at the intersections, terminations, &c. of rail-roads, to answer the purposes hereinbefore described.

I wish it to be understood that I do not claim the exclusive privilege of using guide wheels, neither of shifting them, but only their use in connexion with my self-adjusting apparatus as connected with the car. I do not deem guide wheels to be necessary for the hind wheels of my car; but, if required, they may be made to operate upon the same principle as those of the fore wheels.

JOHN POLLOCK.

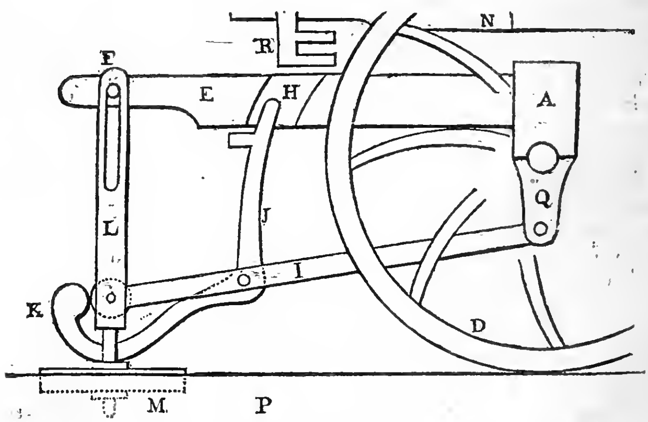
DESCRIPTION OF THE DRAWINGS.

Fig. 1, top view of the carriage.



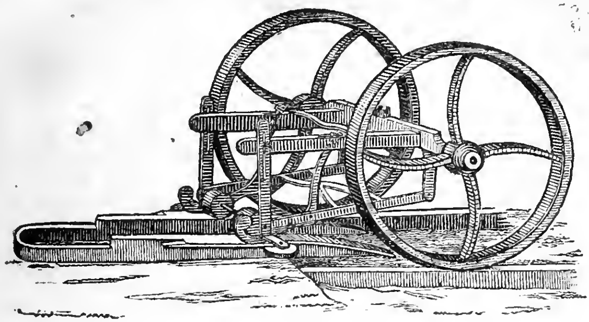
A, A, the bolsters and axles. B, B, the centre bolts. C, C, the coupling rods. D, D, wheels. E, E, the gallows, or arms. F, F, pins for the slings to move on. G, the slider. H, mortise or slits in the slider.

Fig. 2, side view of part of one of the front wheels, and of the principal adjusting parts.



The same letters refer to the same parts in both the figures.
I, fender rails. J, the upper end of the dog. K, its lower end. L, sling attached to the fender rails. M, fender wheels. N, bed sill. P, road rails. Q, projecting pieces forming pivots to the fender rails.

Fig. 3, the fore wheels of the carriage and the guide rail shown in perspective.



Remarks on the Self-adjusting Rail-road and Street Car. By the PATENTEE; *together with some observations upon Rail-roads.*

THE advantages of the "Self-adjusting Rail-road and Street Car" will be more evident, when the many objections to the using of flanches are fully considered; which objections have arisen from experience in their application. It need scarcely be remarked that they are the only means hitherto adopted, generally, for confining the car to the rails. That they have not answered the purpose for which they were intended, as satisfactorily as is desirable, all will admit, who have any experience in their application to rail-roads. They are not only subject to a great amount of friction, by their lateral pressure, against the rails, but this pressure, which creates the friction, is, itself, an evil of no common magnitude, as its effect is to loosen and spread the rails. The cause of this effect is too obvious to need illustration, and its truth is confirmed by the frequent repairs requiring the re-securing of the rails; and the evil will increase with the curvature of the road, as the axles are necessarily placed parallel to each other. They cannot form the radii of the curve on which the car is to move. The rubbing of the flanches will also be increased by increasing the length of the car, and the distance of separation in the axles, as the farther the axles are apart, the more they will deviate from the radii of the curve. This must be an evident defect, as it will render the cars unfit for the transportation of timber, lumber, &c. which will form a great part of their use in this country. That this objection has not been so often repeated, is to be attributed to the almost exclusive use to which rail-road cars have hitherto been applied, viz. the transportation of stone coal and passengers, in which short coupling only is required.

2. As the length of the car is increased, it will be of great importance to increase the distance between the axles also, and that the distance between the wheels of a train of cars, be as nearly equal

as possible, to give them an equal bearing on the rails, and divide their weight equally on them. To accomplish the same purpose, it will be an advantage to load the cars lightly, and have the more of them in train. The rails may also be injured from another cause. The wheels being made fast on the axles, each of them must perform the same number of revolutions; now it is evident, that, on curved roads, this will not be required; and one of the wheels must *slip* and *rub*, thereby creating additional friction, and injury to the rails, as before alluded to. Again, the bed not having liberty to rock on one of the axles, is another source of injury to the rails. The axles being confined to the bed, (though they are permitted to revolve,) will cause all of the wheels to form the same plane with each other on their under edge. Now if the rails in the same part of the road are not on the same plane with each other, (and they are not easily made so at first, and still less easily kept so,) the two diagonal wheels will have to sustain all the weight of the load, consequently the wheels, axles and rails, will have to be stronger than they need otherwise be, and the rails liable to be loosed from their bearings.

3. It will be seen, by a reference to the foregoing specification, that none of these disadvantages accompany the "Self-adjusting Rail-road and Street Car." And that it is not only free from these defects, but is in possession of many valuable properties heretofore unemployed in the construction of rail-road cars. I am the more convinced of this fact, from the undivided opinion of many scientific gentlemen who have examined it at various places where I have exhibited it, and who unanimously concur in ascribing to it such advantages and peculiarities of economy as will warrant its introduction into almost any section of the country. Should any object to the means of confining the car to the rails, on the grounds that it will be insecure, I would answer that they are quite as efficient as that of the flanch. The guide wheels being confined down between the rails, have a controlling power over the other wheels, equal, if not superior, to the flanch, as they are not so liable to be raised out of their places by the lateral pressure as the flanches are, and moreover, the principal wheels being made very broad on the edge, or tread, easily assumes the curves of the rails by the adjusting apparatus having adequate advantage over them.

Any lateral effect by the line of traction, is easily overcome by having a short tongue made fast to, and projected from, the axle as far as the guide wheels, when the end of it may connect the propelling power, by means of a swivel joint, which will bring the lateral pressure directly against the side of the rails by the guide wheels. This supposed defect may be effectually obviated by making the wheels broad on the tread or edge. I should say six or eight inches would be sufficient to admit of any variations in their course, in traversing the rails. This object may also be effected, (as suggested in the specification,) by attaching the system of adjusting apparatus to both ends of the car; and thus the traversing of the axle may be limited to suit the curve of the road which has the shortest radii.

And thus it will be seen that any direct lateral effect against the car, cannot remove it without breaking some of its parts.

4. The fact of its combining the properties of a rail-road and street car, must greatly enhance its value, as articles transported on this car can be carried (off the rail-road into towns, villages, &c.) without unloading, immediately to their place of destination. Consequently, thereby saving an immense amount of labour, expense, and time. Another valuable property arising from this peculiarity of the car, is, that it will cross a common road turn-out from one line of rails to another, without difficulty or delay, and with any required facility by the self-adjusting principle, which principle will be found an important feature in this car. All that will be requisite to enable this car to cross any common road, will be a short platform of plank at the termination of the rails, and side of the common road, to support the guide rails, which are united with the common rails, at crossing places and terminations. Another important feature in the construction of the "Self-adjusting Car," is its adaptation to roads of any curvature, thereby rendering it practicable to avoid the necessity of levelling down hills, as they can be surmounted by winding the road along their sides. The distance, also, between the axles, may be increased to any length, without increasing the friction by the lateral bearing against the curved rails.

5. Another advantage, no less valuable than the foregoing, is anticipated from the introduction of this system. As the rails are not liable to injury from any lateral pressure, and as the extension of planes offers no resistance to rolling bodies, and for the same reason bodies in contact will be less indented by a given pressure, it is obvious that a wooden rail four or five inches broad, would be as little indented by the perpendicular pressure of the wheels as iron plates two inches broad and one-half thick, (which are the usual dimensions, and will cost not less than one thousand dollars per mile, for a single track or line,) and of course may be substituted for the iron. I can speak with more confidence on the comparative advantages of wooden rails, with those of iron, from numerous experiments with a car one-fourth the common size, and two sections of rails, one of wood, the other faced with iron. The car was loaded with three times the proper weight, and run back and forward many hundreds of times, without the lest perceptible difference, and an increase of weight only increased the resistance to the moving power, in the same ratio, which shows that the increase of resistance was the result of friction at the axles. Iron, however, may be used where it can be procured, but its expense would be, in many places, an insurmountable obstacle to the use of rail-roads.

6. The reduction of friction at the main axle, is a subject which many have attempted to accomplish. Secondary, or friction wheels, have been, by some, thought to answer this purpose. They may, if deemed expedient, be applied to this car, with the same effect as any other. I, however, do not recommend them, as their advantage will scarcely warrant their introduction. They have been long before the public, and their merits are fully known. Their chief re-

duction is supposed to exist in the rolling movement they give in place of the slipping one. This seeming advantage is not without its difficulty. The point of contact between the main axle and the friction wheel is so small, that they are easily indented or bruised, in which case they increase what they are designed to diminish.

7. The only resistance to be encountered on level roads, is friction, but as a horizontal plane is not to be expected in the location of rail-roads of any considerable length, another resistance will be to encounter from gravity. A power which will keep the car in motion on the plane, will be insufficient to propel it upon a slight inclination. This will be better illustrated from the following statement. The usual abatement made for friction is one pound to every two hundred of the load. The resistance of gravity will be as the length of the plane exceeds the altitude. In an inclination of 6 inches to the 100 feet, or 26.4 feet to the mile, the resistance from gravity and friction would be 2 pounds; double this inclination, and the resistance will be 3 pounds to every 200 of load, (one-fourth of the load is deducted for the weight of the car, although it is here included,) triple the first inclination will give 4 lbs. to 200. Now if we admit 112 lbs. for a horse power, he will draw on a level 10 tons, and on the first inclination cited above, he will draw 5 tons, on the second $3\frac{1}{3}$ tons, on the third $2\frac{1}{2}$ tons. From these facts it appears that only one-fourth of the resistance in the last result is from friction. This shows that large expenditures in the reduction of friction are not commendable. The ordinary wheel and axle will, in most cases, be the safest, especially if the journals be steeled, and well hardened and polished.

8. The material used in the construction of the principal wheels, should, I think, be cast iron; it is the most durable, and susceptible of the neatest conformation. Caution is necessary in the forming of the arms or spokes, to guard against the contraction which they undergo while cooling in the mould. Small castings contract more in proportion to the quantity of metal than large ones, and as the arms are less than the rim, they are subject to this inequality, as may be seen in the expansion and interstice when they are broken. To remedy this defect, I would make the arms crooked, or curved. The radius of the curve equal to that of the periphery of the rim. This allows the arms to give, or expand, to suit the rim.

9. In the construction of our rail-roads, we have taken England as a model after which to copy, without ever asking the question, whether her plans were adopted from motives of policy, or necessity. This appears to me preposterous. England, it is known, uses iron rails, but may this not be accounted for from the fact, that she has iron in greater abundance than timber. In the United States, the reverse is the fact. Here, population is dispersed over an immense extent of territory, while England is small, and her population dense. To connect the principal cities of the United States would require tenfold the extent of rail-road that it would require to connect those of England. Hence it is obvious that if we would enjoy the use of rail-roads extensively, we must adopt some plan less costly than that

of iron. Wood offers a ready substitute; timber, as fine as the world produces, abounds in our country, which may be procured so cheap, that to make a wooden rail-road would cost but little more than to make a good road for ordinary carriages. These wooden rails may be confined to the ground either by sills of timber laid at right angles, with grooves in which the rails may be imbedded and made fast by keys or bolts; or they may be supported on posts of wood sunk in the ground sufficiently deep to be undisturbed by the effects of frost. Timber which will admit of splitting into pieces of 6 or 8 inches square, will be found the best, as trees which will quarter that size, and are sound, may be considered in their prime. The juices which all kinds of timber contains, and which is a great means of its early decay, should be expelled by kiln drying. This is a cheap and easy process, and would increase the durability twofold. Farmers who have taken the precaution to season well their posts for fencing, will testify to the truth of this observation. Posts have this advantage over sills; where steam power is used, the expense of levelling may be greatly diminished, as the posts may be raised to a considerable elevation above the ground; and this elevation would also be an advantage, as it would tend to keep the rails free from the effects of gravel and frost. Where suitable stones could be procured and set in the ground endwise, with holes drilled into the upper ends by which to secure the rails, they ought to be substituted for the wooden posts.

10. These posts, whether of wood or stone, should be well set into the ground, and secured by ramming a large quantity of broken stones, or pure gravel, around them, and may be placed at intervals of 8 or 10 feet, provided the rails are 8 or 10 inches deep. The rails may be confined to a proper width apart, by small scantling extending across, and made fast to them. The width of the rails should be about 5 feet from centre to centre, or 4 feet 8 inches between them.

11. It now remains for an intelligent community to decide how far these remarks are applicable to the state of our country, and whether we shall wait until able to construct iron rail-roads, or lay hold of the means now in our power, and employ wooden rails, which will ensure, before they are worn out, sufficient capital to construct those of a more durable material. I am firmly persuaded that were we to adopt the foregoing system of car and rail-road, we should so far convince the public of their advantage in a general and commercial point of view, as to insure capital sufficient to construct rail-roads of any description. The great mass of the community are not aware of their advantages, and are not willing to risk their capital in a speculation attended with such enormous expenditures as that of establishing iron rail-roads, while they would willingly contribute to the formation of a wooden one of trifling cost.

Respectfully, yours,

John Pollock.

Specification of a patent for an improvement in the manufacture of Reeds for Weavers. Granted to JACOB SENNEFF, *of the City of Philadelphia, October* 1, 1830.

To all whom it may concern, be it known, that I, Jacob Senneff, of the city of Philadelphia, have invented a new and useful improvement in the manufacturing of reeds for weavers, in which heat is applied for the purpose of straightening the splits or dents preparatory to their being set in the reed, and that the following is a full and exact description of the process, and of the machinery by which the same may be effected.

In accomplishing the end proposed, I proceed upon the well known facts, that wood, or cane, or strips of either, confined in any form, and then submitted to the action of heated water, or steam, or in any way heated, when imbued with moisture, and afterwards dried, will retain the form given to it, whether curved or straight.

I take the strips, or dents, prepared in the usual way for making reeds, and after soaking them in water, arrange them in rows, either upon boards or metallic plates, prepared to receive them, placing them flatwise together, and extending them along nearly the whole length of the board, or plate. Two or more rows may be thus extended, according to the width of the board, or plate, upon one end of which there should be a projecting cleet, or ledge, to sustain them. I cover any convenient number of boards, or plates, in this way, and place them over each other. I then place them in a frame prepared for the purpose, in which pressure may be made upon them, by means of screws, wedges, or otherwise. When thus pressed, they are submitted to the action of heat, and then perfectly dried, which, if necessary, may be quickly done, by placing the whole in an oven.

For the purpose of giving a practical view of my mode of procedure, I have accompanied this specification with a drawing of the press in the form in which I now employ it, not intending to confine myself to this particular construction, as what I claim is not the form of the press, but the process for straightening splits for reeds, upon the principles above described, that is to say:

I claim the mode of straightening splits, or dents, for weavers' reeds, by the united aid of heat, moisture, and pressure, between flat plates. JACOB SENNEFF.

Specification of a patent for an improvement in the preparing of Clay for Making Brick. Granted to JARED G. TALCOTT, *Glastonbury, Hartford county, Connecticut, October* 1, 1830.

THE machine for preparing clay for making brick, is a cylindrical tub open at the top, fixed on a firm platform, with a perpendicular shaft passing through the centre, resting in a socket on a supporter beneath the platform; having a sweep attached to the head of it, for the purpose of causing it to revolve by horses, or other power.

The tub is filled about two-thirds of its depth from the bottom up, with square bars of iron, about four inches apart, passing from side to side, and secured, with the angles of the squares vertical and horizontal, intersecting each other with a small angle, and leaving room in the centre for the shaft. The main body of the shaft is an eight square timber, through every square of which are driven bars of square iron about four inches apart, and in length nearly the diameter of the tub. These are drawn out into horizontal knives, gradually commencing about one-third the distance from the shaft, to the extremity; and these knives are so disposed as to pass through in the revolutions of the shaft, every intermediate space of the horizontal bars in the tub, or cylinder.

By the means of successive revolutions of the shaft with the knives, the mixture of sand and clay, or clay alone, is perfectly prepared, when it reaches the bottom of the tub, where it passes off fit for moulding, through an aperture, into a platform, where the striker stands to perform his labour without any removal of the preparation.

The improvement claimed in the machine, is, the placing the bars and knives in such a position as to clear it from all obstructions of roots, grass, and other substances incidental to clay, without stopping its operation, merely by reversing its motion, which effectually prevents delay, and is a great saving of labour, as well as preparing the clay better with less expense than any machine hitherto used.

Jared G. Talcott.

Specification of a patent for an improvement in the art of manufacturing Malleable Iron from Pig Metal. Granted to Thomas Cotton Lewis, *Pine Creek, Alleghany county, Pennsylvania, October* 1, 1830.

I do hereby declare that, according to the best of my knowledge and belief, I am the original and sole inventor of an improvement in the manufacture of malleable iron by means of a reverberatory furnace for melting and refining the pig metal, without the aid of bellows, or the necessity of coaking the mineral coal. Hitherto, the pig metal has been refined by means of a blast run out refinery, heated by mineral coal coak, or the char of wood; and in consequence of the pig metal being laid, (stratum super stratum,) upon the coak, they melt down together, and the impurities of the coak must, more or less, incorporate with the metal while in a state of fusion. The method I have adopted, will obviate those evils, as well as be a considerable saving to the manufacturer.

A reverberatory furnace is first provided, fifteen feet long in the clear, by four feet wide; the grate, or fire-place, is three feet long, by four feet wide; the body of the furnace is nine feet long by four feet wide; the neck of the furnace leading into the stack is eighteen inches long; the bottom of the stack, or flue, is eighteen inches square, making the whole inside length fifteen feet; over the flue stands the stack, which is thirty-five feet high by eighteen inches

square in the clear. On the side, or front of the furnace, and centre of the grate, stands the stock hole of nine inches square, for introducing the mineral coal into the grate. Upon the same side, or front, and the middle of the nine feet length, is a door for introducing the pig metal, which door way is twenty-two inches wide by eighteen inches high. A door of cast metal is made to shut up said door way, as soon as the metal is introduced, that as little air as possible may be introduced into the furnace. In the centre of the door, and at the lower edge, is an opening of five inches high by three inches wide, for the purpose of agitating the metal while in a state of fusion; while the metal is melting, said hole, or opening, is stopped up by a brick, or piece of cast metal, made to fit such opening. In the body of the furnace, opposite the door way, is the basin for receiving the melting metal, which is ten inches deep below the door way, or fore plate. Said basin is two and a half feet diameter at the bottom, to slope gradually from the upper part, or face of the bottom. Said bottom is made of coarse sand of the silecious kind, and the clearer such sand is of alumine, or calcareous matter, the better it will endure the heat of smelting. When the furnace is sufficiently heated for melting, $\frac{3}{4}$ to one bushel of charcoal is to be introduced into the basin through the door way; after which, one bushel of forge, or hammer cinder, previously made, which cinder is to cover the charcoal previously introduced. After which, eighteen or twenty hundred weight of pig metal is introduced, which is carefully to be laid round the basin, leaving spaces, if possible, between all the pigs, for the action of the flame to facilitate smelting. As soon as the charge of metal is introduced, fresh coals are to be thrown into the grate, the fire well stirred up, and the stock hole closed with small coal, to prevent any current of air introducing itself that way; in fact, no air ought to be let in if it can be prevented, otherwise than through the fire from below the grate. The fire being well kept up for the space of an hour, the metal will have nearly melted; as soon as the workman perceives that to be the case, it will be necessary for him to introduce an iron rabble into the furnace through the opening in the door, and draw the whole of the metal from the sides, into the basin; then introduce $\frac{3}{4}$ to 1 bushel of charcoal upon the face of the metal in fusion. The fire must be kept up as strong as possible, and the metal frequently agitated with an iron bar or rabble. In half an hour after the whole is melted down, it will be sufficiently decarbonized to let it run out through the tapping hole which is upon a level with the bottom, or ten inches below the fore plate, or door sill. Cast metal boxes are prepared, about $3\frac{1}{2}$ inches deep, 20 inches wide, and 10 or 12 feet long, and placed below the tapping hole to receive the metal; in half an hour such refined metal will be ready to take out of the box, and hauled out of the way.

Much depends upon the skilfulness of the refiner, in depriving the metal of its carbon, and, at the same time, to prevent too great an oxidation from taking place. If the metal is sufficiently fluxed, the texture will be clear, and more or less branching like the fibre

of an oak leaf; with from $\frac{1}{4}$ of an inch to an inch of honey comb appearance upon the upper surface.

A furnace upon the above construction, if properly attended to, will refine $3\frac{1}{2}$ to 4 tons, in twelve hours, and consume 15 to 18 bushels of mineral coal to each ton, two bushels of the char of wood, and 22 cwt. of pig metal to each ton of refined metal. The advantages of refining after the above method, will appear obvious to every discerning mind, as the metal is not brought into contact while in a state of fusion, with any part of the mineral coal.

From the intense heat of the furnace, the volatile parts of the coal are consumed, or pass along the roof of the furnace into the flue, while the surface of the metal is protected by the charcoal and the scoria, which in all cases keep uppermost without incorporating with the metal. Refining after the above way will be of great advantage to forges which bloom by means of charcoal, as it will greatly facilitate the procedure and lessen the quantity of charcoal used. The iron made as above is quite malleable, close in texture, and fibrous. One great acquisition is, that said refining furnace requires no machinery attached to it, and may be erected out of the way of all other buildings. THOMAS C. LEWIS.

ENGLISH PATENTS.

To JOSEPH D'ARCY, *Esq. executor of* CHARLES BRODERIP, *for certain improvements in the construction of Steam Engines.* Dated November 29th, 1828.

THESE improvements the patentee divides into three sections:—the first consists of an arrangement of parts, added to the cylinder of the steam engine, by which the beam, side rods, parallel motion, &c. are rendered unnecessary. In this method the piston rod is attached by a moveable joint, or ball and socket, to the piston, and the upper part is connected with a crank, which conveys motion, as required, to other machinery. The piston rod, in its passage upwards, passes through a jointed stuffing box, which slides horizontally along the top of the cylinder, in reverse directions, alternately, according to the strokes of the piston; by this means the piston rod will oscillate, and produce rotary motion, without the assistance of the usual apparatus employed for that purpose.

Another method is described by Mr. D'Arcy for effecting this object, in which he does away with the sliding stuffing box. In this instance the rod is also attached to the piston by a hinged joint; but a metal chamber or trough, sufficiently large to admit of the angular oscillation of the rod encompasses it, and being attached to the piston, it works perpendicularly through an aperture correctly formed in the covering of the cylinder, and well packed to prevent the escape of steam. Of these two methods, the first described is pointed out as being the most useful.

The second section of the invention is what the specifier terms

"a compound connecting frame;" but we are at a loss to discover what novel feature there can be in attaching three cranks to a straight frame of metal, which are evidently the whole of the component parts of this compound connecting frame. It is stated, that it may be adapted with advantage to an engine formed on the principle above described, which, by superseding so much of the usual gear, will be found particularly suited to land and water carriage, from its occupying much less than the usual space.

When it is desirable to place the engine very low down in a vessel, the power can be communicated to the paddles in their ordinary situation by using the connecting frame above mentioned, one of the cranks being attached to the shaft of a spur wheel communicating with the piston; the second, to a part of the vessel to serve as a guide; and the third, to the shaft of the paddle wheel.

The third section, after a lengthy description of a valve, to which no claim is laid, is described as being for the economizing of the caloric employed in the generating of steam, by causing the smoke and heated air proceeding from the furnace, to pass in a horizontal direction through a "steam receiving vessel," and subsequently through a vertical chimney. The valve before alluded to, (which, not being a part of the invention, we refrain from particularizing,) is directed to be placed in the steam pipe between the boiler and the steam receiving vessel, which latter is represented in the drawings of the specification as being a square metal box, divided by a vertical partition; and the patentee lays claim to the operation of shutting off the steam for a stipulated period, as necessity may require, from the boiler to the receiving vessel; but not as regards any other situation. [*Rep. Pat. Inven.*

To BENJAMIN GOULSON, *Surgeon, for certain improvements in the manufacture of Farina and Sugar from Vegetable productions.* Dated December 14, 1829.

THIS patent is stated to be for two distinct processes: the one, for converting certain vegetable productions into farina or flour; the other, for manufacturing the same into saccharine matter or sugar, and are described as follows:—

The roots or vegetable productions to be employed, are dahlia, carrots, turnips, beet, mangel-wurzel, and potatoes. These being well stripped of their skin, or washed, are steeped, either whole, or cut in slices, in pure water and acid, in the proportion of two pounds of acid to one hundred pounds of roots for the dahlia, and increasing the quantity of the acid for the remaining roots, in the rotation they are mentioned, up to ten pounds for potatoes. Any acid substance or acid salt will answer the purpose, but that preferred is sulphuric acid. When sufficiently acted upon by the liquor, the roots will become white and soft: the former is then to be run off, and the latter, after being well washed in pure water to deprive them of the

acid, are directed to be dried in the sun, or in stoves, and then to be ground: farina, or flour, will thus be produced, which may be used in lieu of wheaten flour for making bread.

In the second process, the farina obtained by the above method, is directed to be boiled in dilute sulphuric acid, in the proportion of two pounds of acid to one hundred pounds of farina, and saccharine matter or sugar will by this means be formed, which is clarified in the usual way. The sugar can be also obtained from the roots before being manufactured into farina, by subjecting them at the temperature of the atmosphere to the action of ten pounds of acid to one hundred pounds of roots. [*Ib.*

To THOMAS COBB, *for certain improvements in the manufacture of Paper intended to be applied to the covering of Walls or the hanging of Rooms, and in the Apparatus for effecting the same.* Dated September 15, 1829.

THIS patent embraces several objects relative to the manufacture of paper for hanging rooms.

The first described is a method of manufacturing tinted paper by embossing during the process of making, which is effected by passing the pulp between rollers or plates, one of which, at least, is engraved with any suitable device: the colour is mixed with the pulp previously to its being rolled, and the paper is consequently but of one hue.

The second process is for embossing the paper after it has been made, in which plates and rollers, as in the former instance, are also employed, but with this difference, that one or more of them are directed to be heated, by which it will be made to resemble silks and other substances.

The third is for uniting two pieces of paper together, by means of an apparatus that shall presently be described, for the purpose of giving it a more solid appearance, and also for increasing its durability when pasted against the walls. The sheets or lengths of paper may be either of the same colour, or the one white and the other coloured. The upper or outside sheet may be embossed by either of the means described, or the two may be embossed, after their being joined together, as may be found most convenient.

The fourth part of the invention is for uniting paper with pieces of silk, cotton, or other suitable substance, by which, it is stated, that an appearance of much greater than their actual value will be imparted to the latter. The silks or other substances are coated on one side with any glutinous matter, and being placed in their proper situations on the paper, the whole is passed through the rollers as in the former instance. It is recommended to cause the paper to be twilled, by passing it previously through rollers with grooves formed round their circumference, by which means, it is stated, that the paper will more readily receive the stamp of the embossing roller, and consequently give a sharper appearance to the silk.

The fifth and last object of the patent, is, for the machine before noticed for pasting together the sheets or lengths of paper. In this machine, the white paper to form the under side being wound round a roller properly weighted, to prevent its unrolling too quickly, passes upwards through two rollers covered with plush, one of which may be also converted into a rotary brush; this latter revolves in a box of paste, and coming in contact with the paper, covers it evenly with a coating of the paste. The paper then proceeds upwards till it arrives at a large drum or winding roller, where it meets the other paper on which it is to be pasted, and which is conveyed from the opposite side of the machine by means of guiding rollers; the whole being properly weighted, it is kept distended, and presses evenly with the pasted paper on the drum, on which it is wound to any length required.

In the final clause of the specification, the patentee declares, that he does not claim as his invention, the embossing of paper in general, but only as regards that employed for the hanging of rooms; he also states, that he does not confine himself to the mode described of pasting together sheets of paper, but that the same may be effected by any known method. [*Ib.*

To JAMES STEWART, *Piano Forte Maker, for his having invented certain improvements on Piano Fortes, and in the mode of stringing the same.* Enrolled, September, 1827.

THERE are three features of improvement proposed under this patent; the two first, consist in certain novelties in the construction and adoption of the dampers of double action grand piano fortes; the last is in the manner of attaching the strings to their pins, on all descriptions of piano fortes.

In the first place it is proposed, instead of bringing the damper wire immediately over the string which is to be acted upon, to place it two semitones, or one whole note off. As for instance, if the string to be acted upon is F, then place the wire damper between the string of G and G sharp, and so of the damper wires of all the other strings. The wires of these dampers are to be placed further back in the instrument than usual, in order to leave room for the introduction of a stopper, to prevent the recoil of the hammer after the note has been struck.

The second improvement is taking off the weight of the dampers, to render the touch of the instrument delicate, which is effected by partially raising the damper lever, and only allowing a part of it to bear upon the key.

Third, it is proposed, instead of forming a loop at the end of the string, for the purpose of attaching it to the hitch pin, to fix a very strong hitch pin, and to pass the string round it, bringing the end of the string back again to another tightening pin, and so causing one string to form two unison cords. It is stated that the friction of

the string, on the hitch pin, will be sufficient to hold it, and to allow of the string on each side, constituting two cords to be tuned separately. [*London Journal.*

To Joseph Jones, *Gentleman, for his invention of an improvement in certain parts of the process of Smelting, or obtaining Metallic Copper, from Copper Ore.* Enrolled, January, 1824.

This improvement is designed to assist the fusion of the metal contained in copper ore, and comes into operation after the ore has been brought into that state called regulus, or coarse metal.

Regulus, the patentee considers, contains sulphuret of copper, with sulphuret of iron, and in order to cause the copper to run more readily, he proposes to mix the regulus with a portion of copper ore that is free from sulphur; which, if not pure in its natural state, must be rendered so by calcination. The pure metal acts as a flux to the copper ore, and the iron then flows on the top, which may be taken off by skimming, or drawn away at the tap hole.

The quantity of copper ore required, will depend upon the state of the regulus, which will be readily found, and this process being repeated several times, will considerably expedite the operation of smelting. [*Ib.*

To William Grisenthwaite, *Esq. for a new process of making Sulphate of Magnesia, commonly called Epsom Salts.* Enrolled, February, 1829.

This new process by which Epsom salts are to be produced, is by mixing together magnesia, sulphate of lime, or plaster of Paris, with carbonic acid and water, which will form a sulphate of magnesia.

The magnesia is to be obtained either by precipitation from sea water, or by the common earthy precipitations, or from the magnesian lime stone. The same modes of evaporation and crystallization, are to be employed, as are usually practiced by chemists.

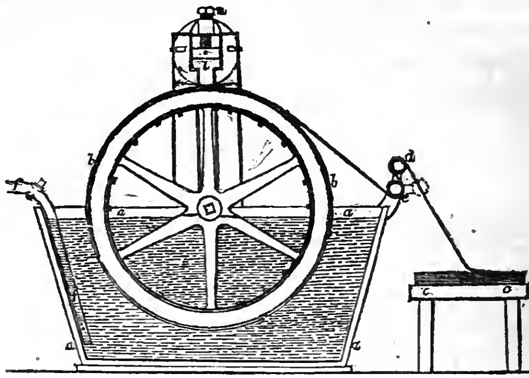
The patentee claims to be the first who has used sulphate of lime, and carbonic acid, for the production of the above salt. [*Ib.*

To Henry Hirst, *Clothier, for his having invented certain improvements in manufacturing Woollen Cloth.* Enrolled, Aug. 1830.

My improvements in manufacturing woollen cloths apply to that part of the process of finishing cloth, where a permanent lustre is given to the face of the cloths, usually by a process called roll boiling, that is, stewing the cloth when tightly wound upon a roller in a vessel of hot water or steam.

As there are many disadvantages attendant upon the operation of roll boiling, such as injuring the cloths by overheating them, which

weakens the fibre of the wool, and also changes some colours. I propose to substitute in place of it, a particular mode of acting upon the cloths, by occasional or intermitted immersion in hot water, and also in cold water, which operations may be performed either with or without pressure upon the cloth, as circumstances may require.



The apparatus which I propose to employ for carrying on my improved process, is shown in the accompanying drawing, which is a section taken transversely through the middle of the machine; *a, a, a*, is a vessel or tank, made of iron or wood, or any other suitable material; I prefer it to be sloping at the back and front, and perpendicular at the ends. This tank must be sufficiently large to admit half the diameter of the cylinder or drum, *b, b*, to be immersed in it, which drum I propose to make about four feet diameter, and about six feet long, or something more than the width of the piece of cloth intended to be operated upon. This cylinder or drum, *b, b*, I construct by combining segments of wood cut radially on their edges, which I secure by screw bolts to the rims of the iron wheels, having arms with an axle passing through the middle.

The cylinder or drum being thus formed, and rendered smooth, on its periphery, and mounted upon its axle in the tank, I now wind the piece of cloth upon it as tightly as possible, which I do by placing the cloth in a heap upon a stool, as at *c, c;* and having passed its end over and between the tension rollers, *d, e*, as shown, and then secured it to the drum, I draw the cloth progressively from the heap, between the tension rollers, which are confined by a pall and ratchet, or otherwise, on to the periphery of the drum, by causing the drum to revolve upon its axis, until the whole piece of cloth is tightly wound upon the drum; when I bind it round with canvass, or other wrappers, to keep it secure.

If the tank has not been previously charged with clean and pure water, I now fill it nearly to the brim, as shown in the drawing, and then opening the stop cock of the pipe, *f*, which leads from a boiler, I allow steam to blow through the pipe, and discharge itself at the

lower end, by which means I raise the temperature of the water in the tank, to about 170 deg. (Fahrenheit.)

Before the temperature of the water has got up, I put the drum in slow rotary motion, in order that the cloth may be uniformly heated throughout, that is, I cause the drum to turn, at the rate of about one rotation per minute, and in this manner I continue operating upon the cloth by immersing it in the hot water, and then passing it through the cold air in succession, for the space of about eight hours, which gives the cloth a smooth soft face, the texture not being rendered harsh, or otherwise injured, as is frequently the case by roll boiling.

After operating upon the cloth in the way described, by passing it through hot water, for the space of time required, the hot water is to be withdrawn by a cock at the bottom, or otherwise, and cold water introduced into the tank in its stead: in which cold water, the cloth is to be continued turning in the manner above described, for the space of twenty-four hours, which will perfectly fix the lustre that the face of the cloth has acquired, by its immersion in the hot water, and leave the pile or nap to the touch, in a soft silky state.

In the cold water operation, I sometimes employ a heavy pressing roller, *l*, which being mounted in slots in the frame or standard, revolves with the large drum, rolling over the back of the cloth as it goes round. This roller may be made to act upon the cloth, with any required pressure, by depressing the screws, *m*, *m*, or by the employment of weighted levers, if that should be thought necessary.

[*Ib.*

To E. W. RUDDER *and* R. MARTINEAU, *Cock-founders, for certain improvements in Cocks for draining of Liquids. August 20th,* 1830.

THE plan proposed to be adopted by these patentees, is, to manufacture liquor cocks out of sheet brass, or other suitable material, by stamping a piece of brass of an appropriate size, by a powerful press and suitable dies, into the form required to constitute the exterior casing, and by a similar process to form the interior of the cock. These pieces are then to be soldered together, with the seam of the one piece on the side opposite to the seam of the other.

The plug is also formed of two pieces of sheet brass stamped into form and soldered together, and also to a top piece which is cast solid. The hollow cavities above and below the liquid way through the plug, are to be filled up with solder or lead, according to the purpose for which the cock is intended.

It is to be regretted that the patentees have not pointed out, in their specification, the advantages of this new method of manufacturing cocks, for the benefits seem far from being obvious, and we fear but few will be able to discover them.

[*Register of Arts.*

To C. Random, Baron de Berenger, *for improvements in Fire-arms, and in certain other weapons of defence. August*, 1830.

The improvements in fire-arms here contemplated, are of two kinds: first, the lock is rendered more secure against accidental discharges; and, secondly, the percussion powder, or priming and charge, are better protected from wet by rain, or accidental immersion in water. The security against accidental discharges is obtained by interposing between the hammer and the touch-hole, a piece of metal to receive the blow in case of the tricker being moved. This guard, which turns back on an arm, can only be removed by drawing back a sliding plate placed under the stock, immediately before the tricker guard; and this sliding plate is drawn back by the left hand when pressing the fowling-piece against the shoulder, in the act of firing, so that no discharge can take place unless the piece is pressed against the shoulder at the same instant that the tricker is drawn. Another modification of this protecting apparatus is described to consist of a pin in connexion with the sliding plate, situated as before, passing into the tricker, and preventing it from moving till the sliding piece is drawn back, as in the other case; and, to render both these plans still more secure, the sliding plate is fixed by a small screw, which can only be released by a key similar to a watch key. This may be useful, occasionally, when a loaded gun is put aside.

To protect the percussion powder, priming, charge, &c. from the injury of rain, the patentee proposes to have the lock entirely within the stock, and an opening, which serves to introduce the percussion caps, has a cover which fits air tight upon it. The touch-hole in this case proceeds in a sloping direction through the breech to the middle of the concave surface of the front of the breech. A vent hole is opened by the act of firing, which allows the escape of the smoke arising from the firing of the priming.

Baron de Berenger's improvements in other defensive weapons, consist in a method of better securing bayonets on the muzzles of muskets, than that generally adopted, and a method of regulating the weight of a sword to the strength of the man using it. When bayonets are made to fit tightly on the muzzle of muskets, they are difficult to fix and unfix, and when they are made to fit loosely, they are likely to be accidentally unfixed when in use, or a horseman can sometimes dexterously unfix them with his sabre. To remedy these defects, the Baron proposes to make the bayonet pass over a projecting sight on the musket, in the usual way; but, instead of the notch for the projection turning twice at right angles, he only turns it once, passing it on by a longitudinal slit of the whole length intended, and then turning it in a transverse slit about a quarter of a revolution. Now, to prevent the bayonet from being turned round and accidentally detached, the ramrod passes into a projecting eye in the bayonet. In order to effect this, the ramrod is to be withdrawn about half an inch, when an opening in the side of the eye passes over the rod; and when it is again returned, a thicker part of

the rod fits into the eye, and prevents the bayonet from being turned till the rod is again withdrawn half an inch. This is really a very simple and secure method of locking the bayonet to the musket.

The other improvement, which applies to the broad or cutting kind of swords, and not to the small or stabbing sword, consists simply of a piece of metal secured upon the back of the sword by screws, and this can be removed at pleasure, nearer to, or farther from, the point to regulate the weight, and, consequently, the momentum of the sword to correspond with the strength of the man using it; for, as his strength varies by exercise, or otherwise, he can vary the momentum of his weapon. [*Ib.*

To SIMON THOMPSON, *Mariner's Compass Maker, for certain improvements in Piano Fortes. August* 26, 1830.

THE improvements contemplated by this patentee apply to the kind of instruments which have been distinguished by the appellation of cabinet piano fortes, and the object is to obviate the necessity for any part of the casing rising above the locking board, so that the top of the instrument is made flat like a table, and there is no silk front before the performer to deaden the voice in case of accompaniment. This object is effected by lowering the string frame till its upper surface coincides with the top of the locking board, and making the keys-bent levers turning twice at right angles between the fulcrum on which they move, and the extremities which act upon the hammers. On the inner ends of each key, rests an upright guide, wire or slight rod, and to this are attached various projecting pieces which actuate the hammers, the dampers, &c. much in the usual manner, so that this improvement, which is a very important one, is obtained without in the smallest degree altering the other parts of the instrument. [*Ib.*

To P. C. DE LA GARDE, *for certain improvements in apparatus for Fidding and Unfidding Masts, and in Masting and Rigging Vessels. August* 27, 1830.

THE old method of fixing and unfixing top and top-gallant masts, is attended with considerable inconvenience and insecurity, and hence have been proposed at different times various plans for facilitating the operation. For several of these, patents have been obtained; we do not, however, recollect any of the plans which are more likely to come into general use than the one before us, as all the operations connected with it are such as seamen are in the constant habit of performing. The fid, which supports the upper mast, consists of two wedges or keys passing from opposite sides over the trestle-trees through a slit in the mast. The wedges are placed with the thick end of the one over the thin end of the other, that the

seat on which the mast rests may be horizontal; and they are drawn into their places by tackles hooked to their smaller ends, at the same time they are sent home by the blows of a mallet applied to their thick ends. When the wedges are brought home, they are secured in their places by locking pieces connecting their ends. The operation of unfidding is performed by changing the tackles from the hooks in the small ends, to those in the large ends of the wedges, and drawing them back, the locking pieces being at the same time disengaged. All these operations are greatly facilitated by a series of anti-friction rollers placed between, as well as above and below, these wedge shaped pieces constituting the fid.

The patentee next describes his method of masting to consist of a kind of iron frame of a rectangular form, with diagonal stays fixed with iron straps to each side of the lower mast near its top. To these iron frames the shrouds are to be hooked instead of being attached to the mast in the usual way, by means of fastenings, which project on every side, and which, therefore, keep the upper mast so far from the lower as to render the fidding both clumsy and insecure.

An improvement in fastening the main sheet and other sails is next described. This consists in placing an iron rod to extend from the fore part angularly across the vessel, to the starboard or larboard side, according as the vessel is upon the starboard or larboard tack. Upon this rod is placed a traversing pulley, which is used for tightening the sail, and the advantage of this arrangement, is, that the pulley can be brought opposite the sail, or rather the end of the yard, in whatever direction it may be placed. [*Ib.*

To JOHN SURMAN, *Lieutenant and Riding-master, in the Tenth Hussars, for improvements in Bits for Horses, and other animals. August* 28, 1830.

THE improvements contemplated by this patentee, are of two kinds—the first, having reference to the form of the bit; and the second, to its connexion with the frame of the bridle, or rein levers. With respect to the first, it would appear that the lieutenant has not yet ascertained which is the best form to be adopted, for he describes several. One plan is to introduce a circular bend in its middle, (thus —⌒—); another, with an elliptical opening in its middle, (thus —○—); a third, with the middle spread out into three branches; and a fourth, with it spread out into four. These are described without any instructions as to the circumstances under which any one, or all of them are to be applied. The first form is certainly not new, and the third and fourth are far from being good, as they will cause a constant pressure on the tongue of the animal to which they may be applied. The improvement in the attachment of the bits consists in permitting the bit, of whichever form, to rotate in the side frames with which it is connected; and this rotation is obtained either by making the bits hollow, and passing a fixed axis through them, or else converting their ends into pivots to turn in the

frames, with collars either screwed or rivetted on their ends, to prevent their slipping out. The rein levers, which are made hollow to a certain extent, are connected to the bridle frame by means of spiral springs, that they may, on the application of force, deviate a little from the rectangular position, and rest upon a projecting circular shoulder. [*Ib.*

FRANKLIN INSTITUTE.

Quarterly Meeting.

The twenty-eighth quarterly, or seventh annual meeting of the Institute, was held at their Hall, on Thursday, January 22, 1831.

James Ronaldson, president, in the chair.

Mr. Samuel J. Robbins, was appointed recording secretary, pro tem.

The minutes of the last quarterly meeting, and also of the meeting held this day, at 3 o'clock, to appoint the tellers, and to open the poll of the election of officers and managers of the Institute, for the ensuing year, were read and approved.

The annual report of the Board of Managers was read and accepted, when, on motion, it was referred to the committee on publications, with instructions to publish such parts as they may deem expedient.

The annual report of the Treasurer was read and approved.

The tellers appointed to receive the votes of the members for the officers and managers, made their report, when the president declared the following gentlemen duly elected officers and managers for the ensuing year.

James Ronaldson, *President.*
Isaiah Lukens, Thomas Fletcher, } *Vice Presidents.*
James H. Bulkley, *Recording Secretary.*
Isaac Hays, M. D. *Corresponding Secretary.*
Frederick Fraley, *Treasurer.*

Managers.

Samuel V. Merrick,	Charles H. White,
Abraham Miller,	Thomas Scattergood,
William H. Keating,	Thomas Loud,
Adam Ramage,	Benjamin Reeves,
Isaac B. Garrigues,	Thomas U. Walter,
Rufus Tyler,	Alexander D. Bache,
John Struthers,	Alexander Ferguson,
John O'Neill,	Joshua G. Harker,
M. W. Baldwin,	John Agnew,
Joseph H. Schreiner,	Charles Toppan,
Samuel J. Robbins,	Mark Richards,
Mordecai D. Lewis,	John Wiegand.

Adjourned.

James Ronaldson, *President.*

S. J. Robbins, *Recording Secretary, pro tem.*

Seventh Annual Report of the Board of Managers of the Franklin Institute.

To the Franklin Institute of the state of Pennsylvania, for the Promotion of the Mechanic Arts, the Board of Managers respectfully present their seventh annual report.

The return of our anniversary meeting calls upon the Board to present to the Institute a general view of the condition of the institution, of the objects which have been accomplished or promoted during the past year, and of those which will require the active exertions of the new Board.

It is pleasing to add that our efforts have met with a due share of success.

Education was the first object of the Institute, as they considered it the corner stone of the edifice which they wished to raise to the promotion of the mechanic arts. With this view it attracted their earliest attention, as well as the uninterrupted solicitude of each succeeding Board; and as far as we have been concerned, it is hoped that every opportunity has been improved to consolidate the excellent system originally adopted. The lectures on chemistry and natural philosophy, with its applications to mechanics, have been productive of that additional degree of usefulness which was to be expected from the increased experience of able professors. These lectures are to be considered as the ground work of instruction in an institution of the nature of ours. Motives of prudence imperatively required, in the origin of the society, that our plans should be limited, in order to be successful; but it is a question which presents itself, in our more mature condition, whether further extension may not be given to our system of education, without endangering its permanency or its usefulness. It is probable that such might advantageously be attempted, and it is a subject to which we would earnestly invite the attention of our successors. Much good has undoubtedly been done; but this reflection, however gratifying, would be productive of little advantage, if it were not followed up by the inquiry, how far this good may be extended? It is not difficult to point out the branches which require attention; the only embarrassment is in the selection of those of most urgency. In this enumeration of *desiderata* in general education, we propose to avoid every thing like a competition with other institutions. Our city is not yet sufficiently populous to require, or perhaps even to justify, a competition on many branches of science, but there are some which naturally belong to our institution, and in which the public confidently expect us to take a lead. Foremost among these we would suggest the subject of machinery, or practical mechanics, as contradistinguished from the theory of mechanics, usually taught in lectures on natural philosophy. Experience clearly shows that the subject is too vast to be embraced in one course; and while it is evident that the rudiments of the science of mechanics are indispensable, it is equally clear that a practical acquaintance with the details of the construction of machines, is an object not less to be desired. Nor is it to

be believed that this point can be satisfactorily obtained by neglecting the other branches of natural philosophy, to concentrate our attention exclusively upon mechanics: for who that was not acquainted with the properties of heat, or with the laws of pneumatics, could pretend to understand the operation of the steam engine, or even of the common pump? &c. and to take an instance from one of the noblest and most recent applications of science to the useful arts, who can pretend to judge of, or justly to appreciate a locomotive engine, that has not first mastered the leading principles of natural philosophy, and then made himself familiar with the construction of machinery? It appears to us that this subject is one which the Institute is now able to undertake, and we would earnestly recommend it to the early attention of our successors. Again, at a moment when the greatest interest has been manifested by this city in the promotion of mining, when much capital is embarked in the search after favourable deposits of mineral wealth, or in the extraction of it from the earth, is it not a subject of regret that there should not be at this moment, in this city, a public course of lectures on mineralogy, and that the able and enterprising individuals, who have manifested an anxiety to lecture on geology, should have met with no cheering on the part of the community to which they were willing to devote their gratuitous services? Such lectures, we are aware, cannot be duly encouraged, unless brought before the public under the patronage of institutions resting upon an independent foundation; but it is from these that men of science have a right to expect assistance; it is to these that our liberal and patriotic citizens look to direct them in their anxiety for the promotion of all that can contribute to the welfare of our community. Other branches, perhaps equally important, naturally present themselves; but enough has been said to show that the great field which the Institute had appropriated to itself, has as yet been but very partially cultivated.

Next to our lectures, and closely connected with them, are our public schools; upon this subject the Board have nothing to add to the reports of their predecessors. The same solicitude for their prosperity was felt and displayed. The same gratifying popularity attended the drawing school; the same failure was again experienced in the attempt to enlist the attention of the public in favour of the mathematical school. Again baffled in their wishes, if not in their hopes of success in the latter, the present Board deem it their duty to state that their opinion of its usefulness remains unimpaired; and while they believe that the present plan has been sufficiently persevered in to justify a conclusion that, on its present foundation, it is not likely to receive adequate encouragement from the community, they would earnestly invite the attention of their successors to this object, that they may consider whether some more popular plan may not be devised, or whether the project is to be abandoned as wholly hopeless. The high school, of which the Institute may proudly boast as an offspring of theirs, continues to flourish and to be useful.

The Board have much pleasure in stating that the experiments upon water wheels, which were projected and prepared in 1829,

have, during the last year, been continued with unremitting zeal and attention by a committee of the Institute. The experiments are now completed; the report is in preparation; and, as it may be expected to be published shortly, the Board will not anticipate at present the information which it is intended to embrace. They will, however, state their conviction, that the results will be found highly interesting to science and the arts, whether in confirming certain theories hitherto resting upon doubtful observations, or in correcting the errors resulting from imperfect and unsatisfactory experiments. The majority of the Board feel themselves perfectly justified in expressing their opinion on this subject, without the fear of rendering themselves obnoxious to the charge of arrogance, as they deem it a duty to add, that the whole credit of it is due to the committee of the Institute to which the investigation was entrusted.

Another important inquiry was commenced and prosecuted by the Institute, during the present year. Its object is to examine into the causes of the frequent explosions of steam boat boilers, and into the remedies which may be proposed to obviate them. This inquiry, which has been continued for several months, has led to the accumulation of much information, collected from various sources, and which the committee, to whom the investigation was entrusted, hope to be able soon to embody into a preliminary report. It was at first believed that, however valuable a series of experiments on this subject would prove to be, it was not in the power of the Institute to undertake it at this time; as it would involve an expenditure too great for the limited funds of our association, and which we did not feel ourselves at liberty to expect from the friends of the Institute, who had so recently, and so liberally, contributed to the experiments upon water wheels. It has, however, occurred in this case, as in all the preceding ones in which the Institute has found itself in pecuniary difficulty, that assistance would never be denied to disinterested and judicious efforts to promote the public good; a fund was placed at the disposal of the committee, which will enable them to extend their inquiries much further than had been originally contemplated. The apparatus for the experiments is now nearly prepared, and it is hoped that they will be soon commenced. If any thing could have added to the pleasure which the Board experienced at the receipt of this fund, it was the knowledge that the efforts of the Institute to promote the success of the mechanic arts, had met with the general approbation of our fellow citizens, as is manifest from the high source by which this proof of unsolicited liberality has been extended to them.

Another of the objects which may be considered as having received the particular attention of the Board, is, the extension of the facilities of the reading room and library. These had hitherto been postponed, from the impossibility of furnishing sufficient accommodations for them. By a fortunate concurrence of circumstances, the officers of the United States' courts were induced to propose that heir lease should be cancelled, under certain conditions, which were deemed sufficiently advantageous to the Institute, to justify us in the

acceptance of them. The rents from our building have, it is true, been partially reduced by this circumstance, but we consider the loss as fully compensated by the increased accommodations we enjoy. The Institute have now the use of the two lower stories of their building, with the exception of the front offices. A new spirit has been infused into the society. A handsome contribution of books, minerals, and money, was immediately raised among the members, and the reading room was opened, under its new organization, on the 23d of September last. The library now consists of upwards of 500 volumes, and is receiving daily accessions. In it are already to be found many valuable works on the mechanic arts; and it is the firm belief of the Board, that with a little attention on the part of our successors, it may soon acquire a value in this department of bibliography which no library in this city, and perhaps none in the country, now presents. In examining into the character of our libraries, it will be seen that among the many public ones in Philadelphia, (not less than 20 or 30 in number,) there is none that possesses any especial value as a technological one. While the city and Loganian libraries, by their extent, and by the rarity and value of their contents, are just subjects of pride to our citizens; while those of the American Philosophical Society and of the Academy of Natural Sciences contain vast treasures in science; while the libraries of the hospital and law society are rich in the departments which they were intended to promote; there is not in Philadelphia a single institution, in which the formation of a collection of books relating to the applications of science to the arts has been deemed worthy of special attention. In a city like ours, this is undoubtedly a great desideratum, and nowhere is it so proper that such a collection should be formed, as within the walls of this institution. With this object, we would beg to suggest that every means be taken to cultivate this department; though not to the exclusion of others, yet giving it a decided preference. It has been asked whether we intended to exclude donations of books not connected with science or the arts? Our answer is evident. By no means. It is desirable to create a taste for books among the members, and particularly the younger ones; who, from the want of opportunity, have been hitherto, perhaps, precluded from extensive reading. This taste we all know is gradually acquired. It must be cherished by giving them works that shall not fatigue their attention, and by affording them that variety which refreshes the mind and stimulates the intellectual as well as the physical appetite. But every opportunity should, we think, be taken to exchange duplicate works, or such as may be deemed irrelevant to the purposes of the Institute for valuable works on the arts, whenever such can be obtained. In doing so, it is believed that we in no manner interfere with the intentions of the donors, who may in all cases be safely presumed to have desired to manifest, by their liberality, their interest in the welfare of the Institution. In effecting exchanges of books, the Board have, hitherto, adopted the rule of carrying those obtained in exchange, to the credit of the donors of such as were parted with. This plan, it is believed, must satisfy all, that the Institute

have no other object than to increase the value of the present. Still the Institute would gladly accept of donations that may be made under a condition that such books shall not be exchanged; and in such cases the conditions imposed by the donors shall be religiously adhered to.

Although the reading room has been opened but a few months, yet its benefits have already been felt; connected with the monthly meetings for scientific discussions, it is seen to increase the interest of the members in the institution: and as the benefits are more extensively shared, they will add to the desire on the part of our fellow citizens, to enlist themselves among the members of the Institute.

This will produce its effect upon our cabinets of models and minerals. The former, though yet very limited, exhibits some very interesting specimens of the ingenuity of our artists.

We must not omit to advert to the exhibition of domestic manufactures held under the auspices of the Institute, in September last; a prouder display of the evidences of American ingenuity and enterprise has, we believe, never been made either in this or in any other city; but on this point we deem it unnecessary to enlarge, as a detailed account of it has already been for some time before the public. It is a point on which this Board has not yet come to a decision, whether the exhibitions had better be repeated annually, or only biennially. Should the new Board determine to hold one next fall, no time must be lost in preparing for it; a plan is under consideration which will, it is believed, contribute much to enhance the brilliancy and usefulness of these interesting exhibitions.

The Board advert also with pleasure to the condition of the Journal, because it is believed to have materially improved in the last year. If not productive in a pecuniary point of view, it at least tends to enhance the character and extend the reputation of our association. It assumes every year a more popular form, and appears to excite more interest in the community at large. This the Board believe to be in a measure due to the excellent plan of publishing the list of patents, with remarks upon all of them. The occasional introduction of the specifications at large is also of primary interest; and we have only to lament that the restricted condition of our subscription list precludes the insertion of a greater number of such as require plates for their elucidation. Hitherto the state of our funds has been such as to prevent our appropriating an adequate compensation to the Editor. Were the Journal such as to allow us to secure the exclusive services of our present Editor, or to associate some other person with him, and to afford a stated remuneration to all contributors, such as is practised with other literary and scientific Journals, there is no doubt that the value of our publication would be greatly enhanced. For this we must throw ourselves upon the enlightened liberality of the public. It behooves every member of the Institute to be zealous in procuring additional subscribers to the Journal.

We have cause to regret also, that more active measures have not been taken to increase the list of members of the Institute. Our numbers appear to have continued stationary, while the demands

upon our funds have greatly increased since the origin of the society. This arises from the great extension given to its sphere of usefulness. It is estimated that the number of annual contributors does not much exceed 600; while there can be no doubt that a society of the nature of ours ought, in such a city as Philadelphia, to command at least 2000. When we look to the extent of our system of education—to the liberality with which it is made to include all the younger individuals of a member's family—to the privileges of the library and reading room, which in other institutions cost more than twice as much as the whole amount of our annual contribution—to the advantages which members have in visiting the exhibitions—and when we recollect that all this is obtained by the small annual payment of three dollars, free from all other charges, we have reason indeed to be surprised that our list of members should not have swelled to a much greater number than that above stated. At the close of their services, the Board deem it their duty to urge it upon the members of the Institute, both collectively and individually, to exert themselves to procure new contributors. If each of them were to make it a point to obtain at least one new member, (a matter of little difficulty,) the benefits which would accrue to all would be inconceivably great, as we should then triumph over the principal impediment that has hitherto retarded our progress.

The Treasurer's report hereto annexed, exhibits a balance of $918 73 in his hands, from which, however, must be deducted, the amount of orders drawn, $296 66, which will reduce that at the disposal of the next Board, to $622 07.

The following gentlemen have, within the last year, become life members, viz.

Henry Seybert,	Joseph Warner,
G. M. Elkinton,	Charles Wetherill,
John Struthers,	William Schively,
John C. Lowber,	I. S. Barnard,
Francis Kearny,	I. P. Morris,
Alexander Ferguson,	S. R. Simmons.

Monthly Meeting.

The stated monthly meeting of the Institute was held at their Hall on Thursday evening, December 23, 1830.

Mr. Thomas Fletcher, vice president, presiding.

Mr. George W. Phipps, recording secretary pro tem.

The minutes of the last meeting were read and approved.

The following donations were presented to the Institute, viz.

By Messrs. Carey and Lea.

The Chemistry of the Arts, being a Practical Display of the Arts and Manufactures which depend on Chemical Principles, on the basis of Gray's Operative Chemist.

Arnott's Elements of Physics, Vol. 2nd, Part 1st.

By M. Carey, Esq.

Rapin's History of England, 15 Vols.

Twenty Pamphlets on various subjects.

By Mr. Isaac P. Morris.

Ferguson's Lectures on various subjects.

Experimental Researches concerning the Philosophy of Permanent Colours, by Edward Bancroft, No. 3.

Phillips' Elementary Introduction to the Knowledge of Mineralogy, by Professor Samuel L. Mitchell.

A Manual of Mineralogy, by Arthur Aikin.

The Eloquence of the British Senate, by William Hazlitt.

An Appeal from the Judgments of Great Britain respecting the United States, by Robert Walsh, Jr.

Roman Antiquities, or an Account of the Manners and Customs of the Romans, by Alexander Adams, LL. D.

By Mr. S. C. Atkinson.

The Casket, for 1830.

By Mr. George W. Phipps.

A Dictionary of Arts and Sciences, 4 *Vols.*

By Isaac Hays, M. D.

Ecole Centrale.

Biographical Sketch of Alexander Wilson.

Documents from the Navy Department, the Post Master General, and the Commissioners of the General Land Office, accompanying the President's Message to Congress.

By Mr. Thomas Harper.

An Address of the Managers of the Schuylkill Navigation Company.

By Mr. James Ronaldson.

A Review of Mr. Cambreling's Report from the Committee of Commerce.

By the Hon. William Marks, Senator.

Documents accompanying the President's Message.

By M. St. C. Clark, Esq. Secretary of the house of representatives of the United States, by resolution of the house.

Journal of the House of Representatives, from the 1*st to the* 13*th Congress, inclusive,* 9 *Vols.*

The Diplomatic Correspondencies of the American Revolution, edited by Jared Sparks, 8 *Vols.*

The corresponding secretary laid on the table the following works, received in exchange for the Journal of the Institute, viz.

The American Quarterly Review, for December.

The Magazine of Useful and Entertaining Knowledge, for November and December.

The Illinois Monthly Magazine, for December.

The Mechanics' Magazine, and Journal of Public Internal Improvements, for November.

Annales des Mines, Vol. 7, Parts 1 and 2.

Annales de l'Industrie et Bulletin de l'Ecole Centrale des Art et Manufactures.

Annales de Chimie et de Physique, for July.

Journal Universel des Sciences Médicales, for June.

Recueil Industriel, for August.

Bibliothéque Physico-economique, for September and October.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale, for July.

A communication from Col. J. L. Sullivan, on the subject of Winans' Friction Rail-way Carriage, was read, and after being discussed, it was, on motion, referred to the committees on publication and on inventions.

The discussion of explosion of boilers of steam engines being called up as the order of the evening, Professor Alexander D. Bache read a letter received by him, giving a further account of the explosion on board the steam boat Caledonia, together with remarks on the subject by the writer.

Other communications on the same subject, were received and discussed, after which they were referred to the committee on explosions, and the subject continued to the next meeting.

THOMAS FLETCHER, *Vice President.*

GEORGE W. PHIPPS, *Recording Secretary, pro tem.*

TO THE FRANKLIN INSTITUTE.

Remarks on WINANS' *Rail-way Carriage. By* JOHN L. SULLIVAN, Civil Engineer.

SIR,—When I submitted to the Institute, in April, 1829, a description of the rail-way wagon, invented by Mr. Winans, depositing a model at your Hall, and soliciting a committee on this invention, I expected, of course, that its imperfections, as well as merits, would not escape their discernment. I considered the Franklin Institute as a tribunal of science, to which every inventor might bring the product of his ingenuity, and offer its *usefulness* to a fair and skilful investigation, in the hope, if not in the confidence, that a favourable opinion of it, by men competent to judge, might introduce it to the public under the *best* auspices; or, its defects being pointed out, be previously remedied. I was not, therefore, disappointed in the result of the report.

My attention had been drawn to this improvement as an instrument in the *public economy* of rail-roads. Experiments with models had given me quite as much confidence as its mechanical combinations warranted; and taking some small interest in its success, I felt that it was not only proper, but extremely desirable, that my own favourable judgment should be sustained, by the good opinion of perfectly disinterested parties.

When, therefore, the committee pointed out certain supposed liabilities to *peculiar* stress, and *unequal* wear, and in expressing the "wish to see a carriage on this construction of full size in operation," suspending their full approbation until this opportunity of mature judgment should arise, I perceived it would be incumbent on me, for the interest of the inventor, as well as for my own credit as a mechanician, to make a further communication when practice should

have tested the value of the machine, and due progress have been made towards its perfection; availing myself of the hints conveyed, with equal politeness and good will, in the report.

To do this, however, it was necessary to wait the slow progress of events; and now, though apparently tardy, I hope and presume a brief account of this invention, up to this time, will be acceptable to the Institute, not only as that of a new machine, but of an instrument concerned in the prosperity, possibly, of Pennsylvania, in the extensive rail-roads she is forming as part of the great line of commercial communication between her capital and the navigable waters of the west. The nature of all mechanical improvements very much depend upon the magnitude of the purpose to which they are applicable, and there are few greater than the cheap transportation of the materials of the internal commerce, together with the agricultural and mineral resources of this state.

In the combinations of mechanical principles, compound leverage in mills, for example, is well known; but I think it had not been usefully applied to carriages until that of Mr. Winans appeared, and with singular novelty and neatness in the mode of his subduing friction in wagon wheels.

It did not escape the notice of the committee, that the *occasional obliquity* of the main axle to the transverse line of bearing under the rim of the friction wheel, would cause the surfaces of it, and the rolling gudgeon of the main axle, to receive at such moments near the *end* of the latter, and the *edge* of the former, the whole weight due to that wheel; and they apprehend, therefore, that *these parts* would wear *most:* but did they not accidentally omit to state that the *ordinary* pressure and wear is *between* these points, and, therefore, if those parts wore down most at such times, still the surfaces must, *on the whole*, wear *equally?* so it seems to me.

Another inconvenience apprehended to be of consequence, was the *endwise* pressure of the axle against the friction wheel, making it operate with its axle as a bent lever to twist the side pieces of the frame out of place. But did not the committee lose sight of the fact, that on rail-roads there can be no considerable "swaying" of the load from side to side? that the moment there exist inequalities sufficient to produce this effect, there can be no *velocity?* that the road must be so out of order, or imperfectly made, as to fail of its purpose? that the two rails of the track must coincide in level? Indeed, so little precaution is required to be taken, that even on the temporary imperfect tracks at the Baltimore excavations, while other causes of injurious wear existed, this effect was not among them.

The accidental *injurious wear* above referred to, both explains the reason of another liability, to which the committee pointed, and in some measure supplies its *disproof.* They supposed the surface of the *rim* would, by the rolling at the gudgeon, not only wear away, but form into grooves, in one of which the rolling gudgeon of the main axle would at length make a permanent lodgment, and reduce the friction wheel to the condition of a common bearing box: it was not, however, adverted to, that before the rolling forward of the

gudgeon in the rim could stop, the friction at *its axle* must be a greater resistance than that produced at its rim. The almost impossibility of thus stopping, was shown in the instance of those first large wagons, put in operation; the friction wheels of these were, (in the absence of Mr. Winans,) cast of *soft* iron, in order to be more easily turned smooth and cylindrical; but they were *so soft*, that their surface crushed under the harder surface of the gudgeon, and wore away; but wore away *equally:* for their very roughness gave the gudgeon a stronger hold, and they would have continued to revolve till worn thin enough to break.

To remedy the defect of the *soft castings*, and this liability to wear as apprehended by the committee, Mr. Winans has now succeeded in casting the friction wheels, not only in very *hard* iron, but the interior of the rim perfectly cylindrical, thus attaining *economy*, *hardness* and *smoothness*. It is found that *chill castings*, in which steel gudgeons roll or rub, work as smoothly and durably as brass. The whole carriage *now* scarcely costs more than the common kind.

The rail-road being well built, the stress on the friction wheel rim must be perpendicular to its axle, (and liabilities to surge, if they exist, may be checked at the frame,) a further improvement on them has now been made. This is to enclose the friction wheel in an iron case, which at once sustains the ends of its axle, keeps off the dust, and serves as the depository of the oil. The case is circular, and is let into the *under* side of the timber, (now single,) far enough to bring the top of the inner surface of the friction wheel *level* with that of the timber. Arms here project from it, by which it is bolted on. In England, where iron is cheap, these arms prolonged and connected, form the sides of the frame. The inner side of the case has an aperture for the main axle gudgeon to enter and lodge under the rim of the friction wheel, and with room for some play. The friction wheel is cast so as to revolve *on* its axle, and not *with* it. The nave bearing, (five inches through,) is cast to a chill pin, which being removed, receives a *cast steel axle*, fixed firmly in its place by means of screw nuts at its ends. The oil being lodged in the case, the joints of which are tight, is taken up by the revolving rim of the friction wheel, and continually carried to its axle, and to the gudgeon of the main axle. All the surfaces that move upon each other are within these four cases, thus thoroughly oiled, yet without waste. Indeed, the same mode of oiling is now applied to the first method, with revolving axles. Both methods are approved at Baltimore. This manner of oiling, as well as the slowness of the movement at the rubbing axle, is very favourable to their use with the speed of locomotive engines.

Feeling assured that the candour of the committee will allow me to meet all their objections by such new facts as have arisen, as they can have no other aim than to guard and to serve the community, I ask leave briefly to notice the remaining one or two.

They thought that the rim of the friction wheel might not be *strong enough* for the stress outwards, from the centre, so as safely to hang the weight of the load by them, there being four on the ends of the

main axles, but that it would sustain the load better, if these rounded ends of the main axles were lodged on the *convex surface* of the friction wheel, then seeming to have the properties of the arch.

But may I not remind the committee that the purpose of the inventor was to avoid all *incidental*, and reduce by leverage the resistance of the *inevitable* friction? He tried the other, and thought the carriage thus more simple; and it is not really material whether the rim be one inch, or one and a quarter thick. *Not one has yet broken with even four tons load.* Besides, there is a peculiar advantage resulting from this lodgment, as I shall have occasion presently to show, in turning the curves of a rail-road.

In operation, the committee thought, too, that as the retarding force of gravity would be just as much against this wagon as against others, that it would, on the whole, be *more;* because the weight of the friction wheels would be superadded. I had, indeed, omitted to mention in my description, that the weight of the main wheels might be *at least* as much lessened, by a small diminution of their size, or otherwise, as lighter main wheels than usual will wear well with the friction apparatus. It is thus exemplified.

In practice at Baltimore, the four friction wheels with cases, weigh 100 lb. The large wheels, 700 lb. Their two axles, 236 lb. The average weight of several complete wagons, 1558 lb. One of the most complete Liverpool wagons tried in competition against one built there by Mr. Winans, both having three feet wheels, weighed 22 cwt. His 21 cwt. Besides, the objection of gravity would not apply, unless that of the friction wheels retarded the carriage more than their leverage helped it.

The committee justly observed that "nothing but actual experiment on a large scale, will fully develope the precise amount of the advantage of a machine of this nature, because it is not possible to foresee all the circumstances which will attend its construction and *use.*" This is true of its use, because its performance does not depend alone upon itself, but also on the smoothness and solidity of the road upon which it is to run. For this reason it would be doing the invention injustice to decide on its ultimate excellence by its performance under the unpropitious concomitants of a new and rough rail-road. Indeed it can hardly be expected that our rail-roads will soon be as perfect as they are made in England, where iron is cheap. A comparison of one wagon or engine with another, to be conclusive, ought to be made on the same road.

At Liverpool, the wagon of Mr. Winans was tried, as before mentioned, against one of the wagons of the rail-road company, each loaded to weigh with the carriage $80\frac{1}{2}$ cwt. under the supervision of Mr. Charles B. Vignoles, one of the most eminent engineers in England. His report thereof was published in the Mechanics' Magazine, in February last. He states in that, and in a letter since printed, that he found the friction of the wagon of Mr. Winans, $2\frac{1}{2}$ lb. to a ton, and of Mr. Stephenson's, $9\frac{3}{4}$ lb. to a ton: both with 3 feet wheels.

It is well known that the usual friction of the common rail-way

carriages is $11\frac{3}{4}$ lb. a ton, and Mr. Stephenson was mainly indebted for the difference, to a part of the improvement of Mr. Winans, *the outside bearing*, for the outside projection of the axle permitted of *more reduction* of size, than the necessary strength of the axle *between* the wheels will allow of. This was Mr. Winans' first improvement.

But perhaps there can be no better method of comparing the friction of rail-way wagons, than by the elevation of the inclined plane down which they will respectively run by the force of gravitation. In the published report of the survey and location of the Baltimore road, this was, as on other occasions, considered by the engineers to be for the common carriage a little more than 30 feet in a mile. But Mr. Vignoles states that he found the friction wheeled wagon would descend by the force of gravity alone, an inclined part of the rail-road of only 5 feet $10\frac{3}{4}$ inches in a mile.

A superiority of 5 to 1 in principle thus conclusively demonstrated in full size, comes very near the original performance of the model. The best kind of wagon may be diminished in useful effect by newness, roughness, curves and ascents in rail-roads; but its superiority in principle over other carriages will still be maintained, though the power should fail to effect as much as it could, were the road smooth, hard, and level.

It is manifest, therefore, that the superiority of that with friction wheels will be great on descending ground, as well as on *level* ground. And especially so in this country, where the location of our greatest rail-roads are likely to be up and down the vallies of our rivers, for it is well known that 4-5ths of the tonnage is outwards.

It is certainly interesting to the public to see this principle in the rail-way wagon, carried in practice as far as it will bear.

Opportunities are likely to occur on the rail-roads between our great cities, which will be remarkably level. It is demonstrable, perhaps, that it is better to make considerable circuits rather than to cross high ridges. *That number of feet elevation* in a *mile*, whereon gravity alone will give motion, has been considered equal to a mile in the expense of power. But though the rail-road from Philadelphia to Columbia rises in some places 27 feet in a mile, it will be, notwithstanding, an advantageous run for locomotive engines, and this wagon will enable them to do much more service than they otherwise could. Because wherever the descent is above 6 feet to a mile, the loaded wagons will accompany the engine with all the speed it could alone attain.

It was a gratifying testimonial in its favour, at Liverpool, that Mr. Ericsson insisted on having these wagons for *his loading*, when proving the efficiency of his locomotive, the celebrated *Novelty*. And he took them rough from the quarries and excavations as they were: for the rail-road company, after the *test*, had agreed for a dozen or two of them. It was thus that the *Novelty* carried 28 tons at the rate of 8 miles an hour, as stated and published by Mr. Vignoles. And I have understood that this convinced the engineer of

the company of their superiority; so too the circumstance of their use on the works under his care is a strong fact.

Indeed the weight of the testimonial given by Mr. Vignoles, is fully equal to that of *any other engineer*, and certainly is very conclusive. His investigations were made with a wagon of full size, in the presence of many witnesses. His report is of careful and repeated trials, and the result is given to the world on the responsibility of his high professional character. It amounts to a recommendation of this improvement to all the rail-road companies in England.

It would be here a fair inquiry on the part of the committee, why the Liverpool company does not employ this kind of wagon wholly. The true answer is, that they had formed an establishment, before this improvement appeared there, to build the common kind, considerably improved in workmanship and proportions, under their skilful chief engineer, who therefore reluctantly yielded to the conviction that compound leverage had a good effect in carriages. And could Mr. Winans have accepted the company's offer to remain, more of the friction wheeled wagons would have been already in use.

It remains to give an account of the progress of this invention in our own country. If not so decisive, it will not be without some satisfaction; and useful and correct information is now wanted by the public on this subject. The Baltimore rail-road, it is generally known, commences on the present borders of the city, 66 feet above tide, and is carried level 7 miles, through and over hills and vallies: and then ascends the rocky valley of the Petapsco, necessarily following the indentations of the hill, along the slope of which it is led by a winding line, the alternate curves of which are often on a radius, (it is said,) of no more, if so much, as 400 feet. In England the radius of rail-road curves is always much greater than this, having probably a better choice of ground. Their roads are nearly straight, and the wheels may be without objection wedged upon the axles.

This location, therefore, appears to have been thought to demand a kind of compromise in determining the size of the wagon wheels. The model, you may recollect, permits the main wheels to turn on the axles, occasionally a little, though in operation actually fixed by the pressure of load, and the comparatively less resistance to turning, at the axles of the secondary wheels. It *was* expected that on turning curves, this would be a convenient property, because there could be no sliding; but the difference in the length of the rails of the curve, be made up by just so much turning of the outer wheels on the main axles; it might be only a few inches.

But on a large scale Mr. Winans found, while in England, that he gained something upon *the resistance* by wedging the wheels fast: and on straight roads there was no objection to it. It then became of less consequence on *which side of the rail the flanch worked;* and he found that by putting them on the inside, as usual there, it permitted of a slight degree of cone in the rim, which by means of the faculty of adjustment in the axle to resistances, was favourable to steadiness in the progress of the carriage.

This probably suggested the idea of an increase of the cone near the flanch to favour the passage of the wagon around those *short curves:* because, on entering them with speed, the wagon would have centrifugal force enough to incline it most to the outer rail, when the effective diameter of the wheel, being increased by running on the cone, while the other wheels run on the lesser diameter of the flat of the rim, measured by equal revolutions the unequal lines of rail; and on taking the reversed curve, with the like effect; their present engineer, Mr. Knight, having calculated the exact degree of conical swell to produce these effects, on the curves of *this road.* On reaching a straight course, or the change of the curve, the vibratory or adjusting action of the main axles takes effect, and establishes the line of steadiness, when otherwise there would be *sliding*, and consequent wear of both the rail-way and the wheels.

The various considerations which entered into the subject, it appears, fixed the diameter of the main wheels at 30 inches. The friction wheels, inside measure, are 9 inches diameter.

The present unfinished state of the first section of the road, does not yet permit of ascertaining the full benefit of the principle, there being but one track; because the heavy loaded wagons are compelled to travel in accommodation to the passenger carriages, a part of the distance ten miles an hour, and five miles ascending 13 feet in a mile. At present, therefore, they do not attempt to carry more than eight tons to a horse. The passage carriages run with about 30 passengers to one horse, at 10 miles an hour, changing at half way.

But I intend, with your leave, to furnish for the Journal the further progress of practice, that the Institute and the public may have knowledge of the facts in this branch of rail-road economy, without the least reserve, wishing that only to be preferred which deserves preference.

Although the extent to which compound leverage might be carried, in rail-way wagons, is not at present determined by experience at Baltimore, still in another respect may be deduced from it, the very satisfactory result, that these carriages will run a long distance without any repairs. One of those for passengers was lately shown me at the rail-road, that had the last year and the present run loaded six thousand miles without requiring any expense upon it, and was said to be still in perfect order. And you may have seen in the Baltimore American, of the 6th inst., that one of those for heavy loads, which had run 1800 miles, was taken apart for examination, and its rubbing and rolling surfaces found in perfect order.

I do not, however, insist, from all that has been adduced, that the committee and Institute ought to feel perfectly satisfied that this improvement is of great consequence in rail-road economy. But will express the hope, that the day may not be remote, when they may see them here of *business dimensions*, and the principle carried as far as may then be found expedient.

Nor do I believe this a vain wish. There are in this state several routes where rail-roads might be beneficial to the public, and well

recompense proprietors. None are more obvious than from Harrisburg to Carlisle, and from the head of Schuylkill navigation to Sunbury, (spoken of in the papers of the day,) and from Philadelphia to Trenton, should one be made across New Jersey.

With acknowledgments to the committee for their attention to this subject, and to the Institute for the indulgence of so large a proportion of their time,

I remain, very respectfully,
your humble servant,
John L. Sullivan,
Civil Engineer.

Philadelphia, December 17, 1830.

Postscript.—Since writing the preceding additional explanation, I have seen the article on Internal Improvement, in the American Quarterly Review, for December, on which, page 293, the subject of rail-roads is a topic, and wherein mention is made of this invention. "Winans, a citizen of New Jersey, has *proposed* a carriage with a new species of friction wheels; and Fleming, a European engineer domesticated among us, has contrived a means of substituting a motion of mere rolling for that of wheels. Both have succeeded completely in model, and in experiments upon the small scale, but practical men entertain doubts, which do not appear to be ill founded, whether either can be actually applied in practice."

This passage, (I have no doubt the Editor himself will admit,) is objectionable, not only in coupling the two inventions, so essentially different, but in speaking *now* of that of Mr. Winans as it might have been spoken of *nearly two years ago.* He passes entirely over its establishment under patent, in use in England, and the account of it not only in an English publication, nearly a year ago, republished at Boston, and repeated in your Journal, in which it is certified by an eminent engineer in that country to have the mechanical advantage of nearly 4 to 1 over the best rail-way wagon before known and used, but also the *obvious practice* on the Baltimore road. The truth is, that the road itself has so absorbed admiration, that probably the Editor, or the writer of that article, may have himself rode on it without knowing that he was also on a friction wheeled wagon.

Now, with all due deference, I cannot see any use in the display of learning on such subjects, when facts so obvious and so pertinent to the very occasion, are not only passed over, *but a groundless prejudice disseminated,* as much at variance with the great interest of internal improvement, as with that of the inventor. For that article, after arguing *pro and con* the question between canals and rail-roads, comes to the conclusion that, "still upon the success of some *friction saving apparatus,* must depend the great question whether rail-roads can compete with canals."

Now, certainly it would have been reasonable, if known, to have adduced in support of this side of the question, *the fact* that such apparatus had actually been put in practice in our own country to an *important extent,* and carried hence acceptably even to England.

Perhaps the committee's report may have had some influence on the writer, and the cautious opinions of scientific and practical men, may have led him to do injustice, not only to the inventor, but to his subject, so immensely interesting to this country. It is not the value of the wagon to the inventor, that is of any comparative moment, but the *value of the machine to the public.* Besides that, if it has such effects in the economy of rail-roads, it must agreeably influence their location, on the very principles explained in the Review, and that will, therefore, greatly extend their benefits, not only where canals cannot be made, but where they already exist, as *tributaries* to their business, branching into districts otherwise incapable of cheap communication with the great navigable line.

The committee, it seems to me, are now invited by a sentiment of patriotism, to look further into the subject referred to their judgment. And I hope they will, in the spring, even make an excursion to Baltimore, and see the wagons of Mr. Winans in operation, and compare their performance with a simple wagon, and then make a supplement to their report, of whatever appears to them to be the practical advantage thus far attained.

Practical Observations on the Pneumatic Process for Expelling Molasses and Sirop from Sugar.

(Concluded from page 409.)

Incidental remarks on the manufacture of Sugar from the Cane Juice into Raw Sugar, and the subsequent products therefrom by refining.

In the manufacture of raw sugar from the cane juice, an expeditious and economical mode of effecting a complete separation of the heterogeneous matter in union with the saccharine, and of producing the greatest weight of crystals of the best quality, is the desideratum of the planter. But does he obtain these advantages by any of the processes now in use in the colonies? Certainly not. Improvements have been introduced in the colonies to a very limited extent, in comparison with those which have, of late years, been adopted in the refining of sugar in Great Britain. It is natural to suppose, that the first and chief aim of science would be to produce a good raw material; that such will eventually be the case, there can be little doubt; as, at this moment, a great excitement is produced in the minds of the planters, by the attempted introduction into the colonies, of various schemes and processes for improving their sugar. This has been particularly the case by Mr. Innes introducing this identical pneumatic process, which aims, not only at the discharge of the *real molasses*, or uncrystallizable matter, but also at the separation of the other impurities still adhering to raw sugar, an operation of refining which, has hitherto been effected by the refiners of sugar in Great Britain.

If this last mentioned separation is deemed of so much importance

in the refining of sugar; and if, as it is admitted, greater and finer products are obtained, when the separation is effected before clarification and evaporation, with the least possible action of heat, surely similar advantages are desirable in the manufacture and crystallization of the cane juice.

Reasoning by analogy, the writer has been induced to believe, that many of the evils complained of by the growers of sugars, especially those of inferior qualities, might be obviated, not merely by an improved method of evaporation and curing, but by arrangements prior thereto. And if the writer's hypothesis upon this point should prove correct, and should be coupled with the recent improvements in evaporation, very superior raw sugars, to those now sent from the colonies, might be made, with less expense and very little increase of attention.

The hypothesis submitted is—

1st. That the sugar cane has its component parts divided, in a greater or less proportion, according to the place or distance from its root or stole.

2nd. That the earthy and denser particles, (and probably the chief portion of the impurities,) blended or united with the saccharine, are nearest to the root; and, in consequence, the saccharine juice is in a purer state progressively, from the root to the top of the cane.

If these positions are correct, would it not be adviseable to cut the lower joints from the cane before it is taken to the mill, to separate the finer portions from the grosser ones, and separately to grind and manufacture their juices? The clarification and evaporation to the consistence required for granulation, would, in the ordinary way of operating, be facilitated, and yield products proportionably better. We know, that the finest fruit is plucked from the extreme bough of a tree; and that that which is nearest to the root is more crude, although equally exposed to the influence of the sun's rays. Separation and selection of qualities is found to be essential in the making of wine, cider, and other vegetable productions; why then may not the same mode of practice apply to the cane juice? If it is found beneficial to separate the part of the cane next to the top, because the matter therein is less ripe than the other parts, surely, by a parallel reasoning, the bottom may contain other matter equally, or perhaps more injurious to the subsequent operations on the juice for the products obtained therefrom.

Under all circumstances, whether the foregoing surmises be correct or not, it must be admitted, that separation of the adventitious substances, intimately mixed and combined with the cane juice, is the first point to be obtained; and secondly, that such separation is best effected with the least possible action of heat, which, in proportion to its intensity and duration, carbonizes and coats the crystals of sugar.

The subsequent separation of this coating from the crystal is, at present, best effected by the pneumatic process; the utility of which in the colonies, for this purpose, would decrease as the improvements in growth, clarification, and evaporation, increased; and, eventually,

the pneumatic process might only be necessary to accelerate and complete the curing or drainage of the real molasses, or uncrystallizable part of the cane juice. Such drainage only, whether effected by this process or by any other, ought to be permitted by the legislature, for reasons before advanced.

In treating upon the refining of raw sugar, it is intended to select those systems which, by practice and analogy, bear upon the subjects under review, instead of attempting to discuss all the varieties existing, and almost daily starting into birth.

Every refiner, either from habit, prejudice, or economy of capital, adopts that system which he thinks best and most suitable to his trade. The opinions and modes of working are almost as numerous as the refineries worked: in some, clarification by blood, with or without a previous separation of the molasses, or colouring matter, is adopted, and evaporation effected by fire pans. Some use charcoal in the clarification, others chemical compounds; some clay the goods, others use magma, or sirop, in lieu thereof; some clarify and evaporate by steam heat, instead of fire, but the most opulent of the refiners have adopted the improvements made by the late honourable Edward Charles Howard, and their products possess a more brilliant appearance, and must rank as superior to those obtained by any of the former methods, with the exception of Mr. Kneller's,* which yields equally brilliant products.

The desiderata of the refiner and planter may be classed as follows:—

1st. The best separation of adventitious substances.

2nd. The separation, clarification, and evaporation, at a degree of heat not affecting the sugar.

3d. The greatest weight of crystals of good colour and brilliant appearance.

4th. The least quantity of molasses or treacle.

5th. The shortest period of manufacturing the products.

6th. The most economical mode of working.

The two first points may be considered as axioms in the art of manufacturing sugar; and, if adhered to, will effectuate the remaining objects; and their practice ought to be adopted, primarily in the colonies, where they would be of greater value than in this country.

Incidental remarks have been made as to the adoption, in the colonies, of a mode of separating impurities combined with cane juice, previously to its being submitted to the action of heat; and the pneumatic process has been descanted upon to prove, that its use would effect the separation of those impurities which still adhere to the sugar after it has been manufactured. The planter is interested in both operations, and especially so in consequence of the immense loss by drainage, and the permission which government, at present grant, to import sugar divested of a part of the impurities and the colouring matter, at the duty payable upon raw sugar, which has not undergone the process of separation; but the refiner's in-

* See page 163, of our last volume.

terest is more immediately confined to the working of raw sugar. Such as it now is, necessity compels him to make the separation therefrom of the impurities and the colouring matter, and this he best accomplishes by a low degree of heat applied throughout his manipulations.

Experience has demonstrated to the scientific refiner, that the admixture of the colouring matter *adhering* to the crystals of raw sugar, is disadvantageous to the refined products, and must be detached therefrom by the process of claying or siroping. The abstraction of the colouring substance, as a primary procedure, has been effected, both by mechanical and chemical processes, none of which have, as yet, been found equally efficacious with the pneumatic process; but with all its advantages, and like the other methods of pressing, claying, or melting, a portion of the finer part of each crystal is dissolved and mixed with the discharged or expelled colouring matter; and, however judicious the operations may be, to separate the crystallizable parts from this colouring matter, by subsequent and repeated operations, still some portion of the crystals remain in the molasses, or treacle, and are therein deposited by natural causes.

In any way, therefore, abstraction of the impurities and colouring matter, previous to clarification and evaporation, must be a positive benefit; because, by the subsequent application of heat, at the temperature required for those purposes, there is an increased tendency to carbonization in proportion to the increased degree of heat applied, its duration and repetition, which likewise operates in an increasing ratio, according to the decrease in quality of the sugar or sirop submitted to its action. The purity of the medium, or solution of sugar, also contributes materially to the abundance and beauty of the crystals.

These positions are exemplified by refining lumps into double loaves: the lumps are refined sugar, and contain a very inconsiderable portion of colouring matter; but it is necessary to separate that small portion, in order to obtain double loaves. Too much heat is applied to melt, clarify, and evaporate, in this second process; the crystals produced are very fine and white, but the residue is treacle; it must, therefore, be evident, that a high temperature, whenever applied to sugar, produces treacle, which invariably is combined with colouring matter; but still the medium in which the fine crystals are formed, is more pure than a solution of sugar not previously refined; thus heat engenders carbon.

In a previous part of this work, statements have been made as to the relative value of raw, pneumatic, and ordinary lump sugars, when used for refining: the advantages of separating the molasses or colouring substance from raw sugar, previously to refining it into loaves and lumps; and also the disadvantageous action of heat upon saccharine solutions, varying according to the degree of heat applied, its duration and repetition, and the quantity of colouring substance contained in them. It may be asked, can such statements and reasonings be substantiated by practice? Investigation is, there-

fore, necessary to ascertain whether such statements and reasonings are founded upon facts. It will be readily admitted, by those gentlemen who are conversant with the principles of refining, that such is the case; but to those who have not a knowledge of the art, it may be needful to prove more clearly, that the positions advanced are correct, by stating—

1st. That

112 lbs. of raw sugar, as imported, yield, by the old system of refining, by the use of a fire-pan, at a mean proof of 240° of Fahrenheit's thermometer,

28 lbs. of treacle.

2ndly. That

112 lbs. of raw sugar, in the same state, yield, by the improved system, by the use of vacuum-pan, at the proof of 155°, (afterwards raised, in the granulating vessel, to 180°,)

20 lbs. of treacle.

3dly. That

112 lbs. of raw sugar, (first partially cleared of the molasses by being made into meltings, and evaporated in the precise manner last mentioned,) yield

14 lbs. of treacle.

4thly. That

112 lbs. of raw sugar, operated upon or refined by the pneumatic process, to produce white crystals, of the quality of ordinary lumps, and the extracted sirops therefrom, evaporated at 245° of heat, will yield only

12½ lbs. of treacle or sirop.

By these comparisons it appears, that by the first method, about 28 lbs. of treacle are produced, when the molasses and colouring substance in union with the sugar, are operated upon by 240° of heat.

2nd method, when in the same state, and at 180°,

20 lbs. of treacle.

3d method, a partial separation of the molasses, &c. having been effected by meltings, and the same heat of 180° applied,

14 lbs. of treacle.

And, by the fourth method, evaporating the extracted sirop and the colouring matter in a more concentrated state, even at 245° of heat, only

12½ lbs. of treacle or sirop.

Thus showing that the degree of heat, and the repetition thereof, engenders an additional quantity of molasses, &c. to that which the raw sugar contained when imported; and that a lesser quantity is engendered when a separation of the molasses, &c. has been effected previously to the action of heat; it may, therefore, be presumed, that raw sugar contains even less than 12½ lbs. per cwt. of treacle, the *least* quantity obtained, at the highest degree of heat employed for one evaporation.

As such, the planter and refiners could not fail to obtain considerable advantages, if they adopted a better mode of evaporating

the cane juice and solutions of sugar to that which is now generally employed.

Charcoal is injurious, because it destroys or weakens the crystallizing properties of sugar to a certain extent; it must, therefore, like lime, be classed as a disadvantageous agent in refining.

The French refiners use from ten to fifteen pounds of animal charcoal to each 100 pounds of sugar; their products possess colour, but are deficient in strength. Some compensation is obtained, by their evaporating to a lower proof than is usual in this country, in open fire-pans, and upon a less quantity for each skipping.

In conclusion, as to the best method of obtaining and applying heat to all purposes connected with the manufacture or refining of sugar, and with due deference to the opinions of those persons who have had a longer and more extensive experience than the writer, he submits that steam heat is to be preferred, and that simplicity in the combinations of the apparatus for that purpose is most desirable, and particularly so for the colonies.

Of all the varied schemes which have been presented to the refiners as improvements for evaporation, that of the late honourable Edward Charles Howard is the most celebrated: by his domed, or vacuum pan, as it is termed, solutions of sugar are evaporated to a proper consistence or proof, at about eighty degrees of heat below that which can be obtained in the open pans now in general use. In the domed pan a vacuum is not formed, but the evaporation of the aqueous particles is accelerated by condensation, in the absence of the atmosphere. After the discharge of the skipping, it is necessary to raise the temperature for granulation to about 185 degrees, which is effected by steam, under the receiving or granulating vessel.

The whole of Mr. Howard's arrangements are highly scientific; but his evaporating apparatus, although it has been much improved, and is less expensive than formerly, yet wants simplicity to render it generally useful, particularly in the colonies.

Many other plans have been devised as substitutes for this scientific and valuable improvement in evaporation; but none accomplishes the object so completely as that of Mr. William Godfrey Kneller, for which a patent has been recently granted.*

By this method solutions of sugar or sirops can be evaporated to proof in an open pan, by steam or other heat, at temperatures varying from 140 to 170 degrees of Fahrenheit's thermometer, consequently at from sixty to ninety degrees below the proof hitherto obtained in an open pan, and about the degree of heat required for granulation.

The apparatus attached is of trivial value, and the auxiliary employed so highly beneficial to the strength or crystallization of the sugar, that such a combination of advantages seems to be best suited to the purposes intended, but it remains to be proved, whether the refiners of this country, and the planters, will adopt this other pneumatic system.

* See page 163, of our last volume.

On the means of giving a fine edge to Razors, Lancets, and other cutting instruments. By Thomas Andrew Knight, Esq. F. R. S. President of the Horticultural Society, &c.

In the preparation of steel, and in the art of subsequently forming it into cutting instruments, the British manufacturers are, I believe, unrivalled; and they have probably approximated, if they have not attained, to perfection: but in the art of giving the finest possible edge to their instruments, when formed, I think they have generally still something to learn; for I hear surgeons often complain that they rarely find themselves in possession of a well set instrument; and I have never yet, in any instance, seen a razor come from a cutler so set that I could use it with any degree of comfort; though I have obtained razors from many of the most eminent manufacturers of the metropolis. The machinery which they employ, has long appeared to me to be imperfect, and uncertain in its mode of operating, and in many respects inferior to that which I have been some years in the habit of using, and which I shall proceed to describe.

This consists of a cylindrical bar of cast steel, three inches long without its handle, and about one-third of an inch in diameter. It is rendered as smooth as it can readily be made with sand, or, more properly, glass paper, applied longitudinally, and it is then made perfectly hard. Before it is used, it must be well cleaned, but not brightly polished, and its surface must be smeared over with a mixture of oil, and the charcoal of wheat straw, which necessarily contains much siliceous earth in a very finely divided state. I have sometimes used the charcoal of the leaves of the *elymus arenarius*, and other marsh grasses; and some of these may probably afford a more active and (for some purposes,) a better material; but upon this point I do not feel myself prepared to speak with decision. In setting a razor, it is my practice to bring its edge, (which must not have been previously rounded by the operation of a strop,) into contact with the surface of the bar, at a greater or less, but always at very acute angle, by raising the back of the razor more or less, proportionate to the strength which I want to give to the edge; and I move the razor in a succession of small circles, from heel to point, and back again, without any more pressure than the weight of the blade gives, till my object is attained. If the razors have been properly ground and prepared, a very fine edge will be given in a few seconds; and it may be renewed again, during a very long period, wholly by the same means. I have had the same razor, by way of experiment, in constant use during more than two years and a half, and no visible portion of its metal has, within that period, been worn away, though the edge has remained as fine as I conceive possible; and I have never, at any one time, spent a quarter of a minute in setting it. The excessive smoothness of the edge of razors thus set led me to fear that it would be indolent, comparatively with the serrated edge given by the strop; but this has not in any degree occurred, and, therefore, I conceive it to be of a kind admirably adapt-

ed for surgical purposes, particularly as any requisite degree of strength may be given with great precision. Before using a razor after it has been set, I simply clean it on the palm of my hand, and warm it by dipping it into warm water; but I think the instrument recommended operates best when the temperature of the blade has been previously raised by the aid of warm water.

A steel bar, of the cylindrical form above described, is, I think, much superior to that of a plane surface for giving a fine edge to a razor or penknife; but it is ill calculated to give a fine point to a lancet, and I therefore cause a plane surface to be made, a quarter of an inch wide, on one side of the bar, by cutting away a part of its substance; and I have found this form to be most extensively useful.

The edge of some razors, whether formed of wootz, of mixed metals, or of pure steel, but particularly of mixed metals, has generally appeared to me to be more keen and active when used a few seconds after it had been applied to the bar, than on the following day; and I have often seen the utmost activity restored to the edge of such instruments, so instantaneously, and by so apparently inadequate means, that I have been sometimes led to suspect the operation of the bar to have been something more than that of having worn away a minute portion of the metal; but I am not disposed to offer any conjectures respecting other effects which I may have conceived it to produce.

I have in many instances been able to give a very fine edge to razors in possession of my friends, which I could not set tolerably well by any of the ordinary means; and I have found that those composed of different materials could be set with equal facility, though the sensations they excited, when used, appeared to me to be in many instances dissimilar. The instruments upon which I have chiefly made experiments, have come from the manufactories of Mr. Pepys, Mr. Stoddart, and Mr. Kingsbury. The material which appeared to me to receive that which I shall call the most eager edge, (and it was very durable,) was wootz, from the manufactory of Mr. Pepys; and that which received the smoothest edge, and which I thought best calculated for surgical purposes, was a mixture of rhodium and steel; the powers of the pure steel of Mr. Kingsbury, appeared to be intermediate; and my experience leads me to believe that, under different circumstances, each of these materials might be used with some exclusive advantages.

[*Journal of the Royal Institution of Great Britain.*

The Chemistry of the Arts, being a practical display of the Arts and Manufactures which depend on Chemical Principles, on the basis of Gray's Operative Chemist. By ARTHUR L. PORTER, late Professor of Chemistry in the University of Vermont. *Carey & Lea,* 1830.

THE work, on the basis of which the above treatise has been written, is already advantageously known; the demand for it, even at

the expensive rate at which it could be imported, was such as to induce the enterprising publishers, from whose press the work issues, to supply it at a price bringing it more within the reach of those for whose benefit it was especially written. The American Editor has had, abroad, opportunities of inspecting, minutely, the various processes which he has described, and we can but regard the portions coming from his pen, as not the least interesting of the work. Mistakes are corrected, full articles on interesting subjects added to the often meagre results, furnished by the state of information at the time when the operative chemist first issued, and the work concludes with a well arranged detailed statement of the processes of bleaching, dying, and calico printing, contained in more than one hundred pages. The plates, of which there are many, are well executed, and the lettering is generally very correct. The expense of the plates has not been suffered to enhance the price of this book beyond what one should willingly pay for a work important as this; the best and most modern which we have upon the chemistry of the arts.

In order that our readers may be able to judge of the character of the work of which we have just spoken, an extract, from one of the articles of the American Editor, is presented: the article from which this is taken, is on the important art of bleaching.

Bleaching.

Bleaching, in its broadest acceptation, is the art of removing the colouring matter, whether naturally or artificially acquired, from all bodies in the mineral, vegetable, or animal kingdoms. Its most important applications, however, are to those fibrous substances, so extensively used in the fabrication of the clothing of civilized men, cotton and linen, and to these I shall devote the principal part of this article. I shall treat first of the substances, or agents employed in art; and, secondly, of the processes and manipulations, in the order in which they occur.

The materials now used in bleaching are only five in number; viz. water, lime, potash, sulphuric acid, and chloride of lime.

The quality of the water is a consideration of the first importance in the location of a bleachery. No refinement of art has enabled bleachers to surmount the obstacles presented by bad water. Waters impregnated with the muriates, carbonates, or sulphates of lime and magnesia, or with the muriatic, carbonic, or sulphuric acids, in excess, familiarly known by the term, *hard waters*, are unfit for the purposes of bleaching. The small quantity of alkali necessary to precipitate the earthy bases and neutralize the acid, does, indeed, present no serious objection to their use in bucking, nor is there any objection to their use as solvents of the chloride of lime and the vitriolic acid; but their bad washing properties forbids the employment in the dash wheel, where the great demand for water lies. These waters are readily known by the property they have of forming curdy or white precipitates, on the addition of a watery, or alcoholic solution of soap, occasioned by the union of the mineral acid

with the alkali of the soap, and the consequent displacement of the oil, which floats upon the surface. The protocarbonate of iron is sometimes found in natural waters, and is very objectionable in bleaching processes. Waters containing this salt exhibit a reddish ochery scum on standing, which is also deposited upon the banks of pools and sluggish streams. The presence of carbonate of iron is detected by the addition of a few drops of a tincture of nut galls, which produces a purple precipitate. The ferro-cayanate, (formerly *prussiate*,) of potash will produce a beautiful blue precipitate, if the water be previously acidulated with a few drops of sulphuric acid. The muriate and sulphate of iron are more rarely found in natural waters, but when they are present, may be detected by the same means. They are alike injurious in bleaching.

Muddy or turbid waters are obviously unfit for the purposes of bleaching, and particularly for the last washings. They may answer for the earlier processes, provided spring or other clear water can be obtained for rinsing. This is the only species of impurity in water which can be remedied by filtration through sand and gravel, which is an indispensable operation on streams whose banks are muddy and liable to frequent and sudden inundations.

The waters of many streams, particularly those which flow through marshy grounds, are tinged of a yellowish or greenish hue, owing to their holding in solution certain vegetable matters. This is one of the most formidable obstacles to a good bleach, and has not yet been surmounted by art.

From the foregoing remarks, it is obvious that the means of judging of the fitness of water for bleaching purposes, are extremely simple, and attainable by every individual, without even the humblest pretensions to science. A water that is limpid and colourless, that does not precipitate an alcoholic or watery solution of soap, (or, in common language, that is *soft* and will *wash well*,) and that is not discoloured by the addition of an infusion of nut gall, or an acidulated solution of ferro-cayanate of potash, or that does not deposit an ochery matter on the banks of water courses,* may be safely relied upon as in every respect well adapted to the processes of bleaching.

Lime suitable for bleaching should be recently and thoroughly burned, and colourless; in other words, lime that is white, and in other respects adapted to masonry, will answer the bleacher's purpose.

Potash, the vegetable alkali, is another important agent in the bleaching art. This article is never found pure in commerce; besides accidental impurities, it is always united, to a greater or less extent, with carbonic acid. Commercial potash is a mixture of pure potash with the subcarbonate of potash, sulphate of potash, silex, minute portions of other earths, and occasionally of undecomposed

* The ochery matter frequently observed to be deposited on the banks of rivers from the oozing of minute springs, should not be mistaken for a deposit from the water of the stream itself, as such deposits are generally too inconsiderable to affect the general purity of the water.

vegetable matters. These foreign matters exist in very variable quantities in the potash of commerce, and it becomes an important object with the bleacher to find a convenient method of determining the exact amount of real alkali in it, and of course the comparative value of the different lots offered in the market, as a guide to aid him both in his purchases and in the subsequent use of it in his processes. The alkalimeter of Dr. Ure, founded on the quantity of sulphuric acid required to neutralize 100 grains of potash, is a convenient instrument for this purpose. One hundred grains of pure potash will require 105 grains of concentrated oil of vitriol for perfect saturation. The method of procedure is this:—provide a glass tube, sealed at one end, 9 or 10 inches long, and three-fourths of an inch in diameter, and graduate it into 100 equal parts. It is convenient to have the graduation commence a little below the extremity of the open end. The exact contents of this measure is not important, provided the graduation is exact. Such graduated tubes can be obtained at any of the glass houses. Into a tube of this description, introduce 105 grains of concentrated sulphuric acid of a specific gravity, 1.850, or 170° on Tweedale's hydrometer, and fill up the remaining graduated spaces with water; decant the mixture into a wider lipped glass vessel, and stir with a glass rod till the union of the acid and water be complete. Now, as the whole 100 measures contain a quantity of oil of vitriol equivalent to 100 grains of pure potash, it is obvious that each measure of the liquor in the tube is adequate to the neutralization of one grain of potash, and the number of measures required for the neutralization of a solution of 100 grains of any commercial sample is an exact measure of the quantity of real potash contained in it, and, *vice versa*, the number of degrees remaining in the tube is the measure of the impurities contained in the sample. The point of neutralization is ascertained as usual in such cases, by cautious additions of the acids, stirring the mixture on every addition, and trials of the changes of colour produced on litmus and turmeric papers by the liquid. It is proper to caution the operator against a frequent source of error, pointed out by Dr. Henry, in his excellent directions for the manipulations in alkalimetry, from the presence of the disengaged carbonic acid, which, by acting on the litmus paper, may lead him to infer an excess of sulphuric acid. This source of error may be avoided by warming the liquor towards the last of the process, by which means the disengaged carbonic acid is expelled.

Of the oil of vitriol of commerce, one of the next most important agents in bleaching, little need be said. It is generally sufficiently pure as it comes from the manufacturer, for every purpose of the bleacher. It should be colourless, and have a specific gravity of 1.850, or 170° T. If it have a specific gravity greater than that, its purity may be suspected. The usual impurities are sulphate of potash and sulphate of lead. The latter may be detected by a precipitation, on the acid being largely diluted. I am not aware that either have any injurious effect in the bleaching process. But the acidemeter is the readiest method of determining the comparative value of commer-

cial samples, and this is no other than the alkalimeter just described, only reversing the method of procedure;—100 grains of pure potash is to be dissolved in 100 measures of water, in the graduated tube, and portions of the solution added cautiously to 105 grains of the oil of vitriol to be operated on, previously diluted with four or five times its weight of water, till the acid is neutralized. The number of parts, on the graduated tube of the alkaline solution, required for this purpose, will determine the per centage of real acid contained in the sample;—if eighty parts of the one hundred degrees are required for this purpose, then is there eighty parts of real acid in every one hundred parts of the sample.

The last article essential in the bleaching process, is the chloride of lime, or bleaching powder. The introduction of this compound constituted an important era in the history of the bleaching art. What was formerly a work of several weeks, is, in modern bleaching, accomplished in as many days, and with a proportional diminution of labour, and great reduction in expense. The tedious exposures to sun and air, to which, in the old method, the goods were necessarily subjected, are entirely superseded by the use of chloride of lime. The manufacture of this article is described under the head of chloride of lime in this work. It is a dry white powder, having a slight smell of chlorine, and a peculiarly strong, acrid taste, not very unlike the muriate of lime. It is partially soluble in water, to which it imparts its smell and bleaching power. The undissolved portion is an hydrate of lime united with a small proportion of the chlorine. The value of chloride of lime depends wholly on the amount of chlorine it contains. We meet with very variable proportions in the commercial specimens. Bleachers generally judge of the strength from the specific gravity which it imparts to the watery solution. If the powder be dry and have the odour and taste of a good article, the specific gravity is not an indifferent measure, though I have not found it uniformly correct. 5 lbs. of the best bleaching powder should impart to its solution in an ale gallon of water, a specific gravity of 1.025, or 5° T. But a more correct test of the value of this article is to be found in its power of discharging the colour from a diluted solution of indigo in sulphuric acid; for directions for using this test the reader is referred to the article, which treats of the manufacture of bleaching powder in this work. It ought to be known to the bleacher that chloride of lime loses strength by exposure to the air, and to a certain extent even when it is kept in close casks; by free exposure to the air the chlorine escapes, or rather is expelled from the lime by the joint operation of the carbonic acid and moisture of the atmosphere, and a carbonate instead of a chloride of lime remains; no more than one cask, therefore, should be allowed to be open at any one time, and that should be kept as much excluded from air and moisture as possible.

I will now proceed to describe the various processes of the art in the order in which they occur in the bleaching of cotton shirtings and sheetings.

The Steep.

The goods as they come from the loom are impregnated with flour, paste, or starch, used in the process of manufacture. To free them from this foreign matter, they are thrown in loose bundles, each piece by itself, into any large vessel, or cistern, capable of containing the quantity to be operated on, which I will suppose throughout this treatise to be one ton nett, or 2000 lbs. The form of this vessel is a matter of no importance whatever; a common wooden cistern, such as is used for the scouring and bleaching liquors, will answer every purpose, provided there is a means of warming the water in winter by steam; but if this cannot be conveniently done, a spare bucking keir may be made use of when artificial heat is required. On the introduction of every layer of cloths, sufficient water should be admitted into the steeping vessel to wet them, and, in order to secure this object effectually, while one man is employed in putting the goods into the cistern, another should tramp them into the water. It is better that no more water should be used than is sufficient to cover the goods when pressed down. In this state the cloths should remain till a gentle fermentation is produced, which may be known by the appearance of a frothy scum upon the water, and a sour smell from the cistern. In fact the acetous fermentation of the paste, and perhaps some vegetable principle of the cotton along with it, has taken place; its elements have assumed new combinations, and become more soluble in water. It is probable also that the acetous acid which is formed, may, at this early stage, exert a highly beneficial solvent power on the natural colouring matter of the cotton. The time requisite for the steep depends much on the season of the year, or rather on the temperature to which the goods are exposed; during the summer months, twenty-four hours, and sometimes less, will be found sufficient for this purpose; in spring and autumn, from one to two days are necessary; and in winter, artificial heat is indispensable to despatch in business; the acetous fermentation is very sluggish below 50° Ft.: it takes place readily at 60°, but does not attain its greatest activity below 80°, or perhaps 90°. When artificial heat is used, care should be taken not to allow a temperature approaching to a scald, which is supposed to produce a change on the starch or paste, unfavourable to the necessary fermentation when the proper temperature is afterwards acquired. It is scarcely necessary to remark, that the steeping process, if carried too far, would endanger the strength of the fabric. Some bleachers employ for the steep the spent alkaline leys, instead of clean water; a practice highly objectionable; 1st, because it retards the fermentation; 2nd, because this alkaline liquor is already loaded, perhaps saturated with the colouring matter of the cloth, and would be more likely to deposit than to take up an additional quantity at the low temperature of the steeping liquor; and, thirdly, because the acetous acid of the fermentation must, by combining with the alkali of the ley, have the direct effect of precipitating the colouring matter, with which it was previously united, directly upon the cloth. It is a singular circumstance that a practice so fraught with objections, and so opposed to the ac-

knowledged theory of bleaching, should have been either passed over in silence, or noticed with commendation, by all the respectable writers who have treated of the subject. The fermentation of the *steep* might be greatly expedited by the use of a very small quantity of yeast made from damaged flour, which might be deposited near the centre of the lot; but in this, as in the introduction of the slightest innovation upon established practices, the enlightened bleachers may calculate on encountering the prejudices of old workmen in the art. After the steep, the goods are to be opened out of the band, or bundle, in which they are usually made up, and well washed in the dash wheel. Some bleachers improperly omit this washing.

[TO BE CONTINUED.]

On the Setting of Plaster of Paris. By M. GAY-LUSSAC.

EVERY body knows the property of plaster, deprived of water by heat—of forming a hard body with that liquid. The consistence which it acquires is very variable, and those are decidedly the purest plasters which set with the least water. The cause has been attributed, for that of Paris, to the presence of a few parts per cent. of carbonate of lime, but doubtless very erroneously; for the heat necessary to bake plaster, which, on a small scale, does not rise to 150°, (= 302° Faht.) is not raised, in the large way, to the degree necessary for decomposing carbonate of lime; besides, baked plaster does not usually contain free lime, and the addition of that base to plasters of little consistence does not perceptibly improve them. I think that the difference of the various degrees of consistency acquired by baked plasters with water, must be sought in the hardness which they offer in the raw state; a hardness we cannot explain, and which must be taken as a fact. This laid down, I conceive that a hard plaster stone,* having lost its water, will acquire again more consistence in returning to its first state, than a plaster stone naturally soft; it is, in a manner, the primitive molecular arrangement which is reproduced. Thus, we see, good cast steel, from which its carbon has been taken by cementing it with oxide of iron, give, afterwards, by a new cementation with carbon, a steel much more homogeneous and more perfect than that which would be obtained, in the same circumstances, by the cementation of iron.

[*Ann. de Chimie.*

Dying of Silk a Permanent Chrome Yellow. By M. OZANAM.

CLEANSE the silk at one heating of two hours, wash and wring it; plunge the skeins in a solution of sub-acetate of lead more or less

* What is commonly called plaster stone, (pierre a platre,) consists of impure masses of sulphate of lime. It is usually mixed with clay, sand, carbonate of lime, and contains animal and vegetable remains. The sulphate of lime contains twenty-one per cent. of water of crystallization. It is softer than marble in general.—See Thenard's Chemistry, II.—TRANS.

strong, according to the desired depth of yellow. At the end of two hours take them out, expose them to the air for half an hour, then wash them in a stream and wring them.

Prepare a bath, in which a sufficient quantity of neutral chromate of potash, (about from the fifteenth to the twenty-eighth part of the weight of the silk,) is dissolved. Neutralize the bath with half a glassful of hydrochloric, (muriatic,) acid. Leave your silks in it, during half an hour, at the mean temperature: twist or wring them over the liquor, and wash them in a slight solution of soap, just warm, then in a stream of cold water.

The shades of yellow are varied by altering the quantities of the mordant of sub-acetate of lead, and of the chromate of potash, which must always be deneutralized by hydrochloric acid.

[*Recueil Industriel.*

Maryland Institute.

We learn with great pleasure that our sister institution, the Maryland Institute, is in a prosperous condition, and pursuing with activity a course of great usefulness.

This society was founded in November, 1825. Its objects are the encouragement and promotion of manufactures, and the mechanic and useful arts, by the establishment of popular lectures upon the sciences connected with them; by the formation of a library and cabinet of models and minerals,—by awarding premiums for excellence in those branches of national industry deemed worthy of encouragement—by examining new inventions submitted for that purpose—and by such other means as experience might suggest.

In January, 1826, a bill incorporating the Institute, passed both branches of the legislature of Maryland. In the course of the same year, several lectures were delivered by gentlemen, who volunteered their services for this purpose; an exhibition of the products of our mechanical industry was also announced.

The encouragement which was given to the new institution in its incipient state, justified the exertions that were made by the Board of Managers to place it immediately on such a footing of usefulness, as alone could impart to it stability and permanency. To produce this effect, no expenditure of time or money, consistent with the hopes which were justly created by the general interest manifested in behalf of the institute, was spared.

The Managers adopted measures to procure, as early as possible, an extensive apparatus, by means of which the lecturer could make all the necessary illustrations of the fundamental principles of mechanical and chemical philosophy. This having been obtained, the lectures, which had been partially suspended for want of the necessary apparatus, were resumed early last winter, and judging from the manner in which they were attended, appear to have given satisfaction.

Through the exertions of our worthy and efficient delegates, an

annual appropriation of three hundred dollars was made by the legislature. The lecture room has been so fitted up, as to afford comfort to the auditors, and enable the lecturer to carry on his demonstrations to the advantage of the respective classes.*

Mr. Julius T. Ducatel has been appointed to lecture on natural philosophy and chemistry.

The number of subscribers to the society has increased, and the Managers and officers have, we learn, resolved to spare no exertions to secure to the public all the benefits originally contemplated on the foundation of the institution.

The following report will show the prosperous condition in which the Institute commences the operations of its sixth year of existence, and we wish every success to its laudable exertions.

Report of the Managers of the Maryland Institute.

The Board of Managers of the Maryland Institute for the promotion of the mechanic arts, deem it proper, at the commencement of another season of lectures, thus publicly to address the members, and the public generally, on the subject of the Institute committed to their charge. With varying success, this has continued from year to year, until it has become finally, and it is hoped permanently, established. Its object is by this time, too well known to need detailed explanation; it is sufficient to say, that, as its title purports, it aims, and has constantly done so, at the improvement of the mechanic and manufacturing arts, by placing the aids of the science connected with them, in the easy reach of their practisers and professors. Nor, is it believed, has it been altogether without useful attendant results.

The Maryland Institute, however, like many public establishments, lives on the health of public favour, with a better chance of continued existence perhaps, from the fact, that it does not call upon the *charities* of the community, but urges it on the score of its *interests*. To the members and to the public, the Board of Managers, therefore, now address themselves.

During the last winter, the chairs of chemistry and natural philosophy applied to the arts, were respectively filled, and full courses of lectures were delivered on these branches of science. The lecturers were the better enabled to effect this from the excellent accommodations in the Athæneum, and from the apparatus received from France, of a superior kind, and forming the chief part of an order, which, when it is all received, will make the apparatus of the Institute as full and complete as could be desired. The classes which attended the lectures were numerous, attentive, and composed of those who came to learn, and whose learning, when obtained, would be made of use and value, by their industry and intelligence. The drawing school under the direction of Mr. Smith, one of the ablest teachers in the country, and the secretary of the Board of

* Chronicle of the Times. Edited by J. T. Ducatel and G. H. Calvert.

Managers, was opened during the winter, under the auspices of the Institute.

Owing to the exertions of the delegation from this city in the legislature, this body appropriated the sum of three hundred dollars annually to the use of the Institute, so long as it shall be in efficient operation. This sum, though small, is satisfactory, both in the pecuniary assistance which it affords, and the interest which it evinces on the part of the state, in the success of the institution. Depending too for continuance upon the permanent efficiency of the Institute, it will act as a spur to the friends of the latter, to prevent the aid thus given, from being forfeited by neglect or inattention.

The Board of Managers, in making their arrangements for the ensuing season of lectures, deemed it expedient to unite the two chairs of chemistry and natural philosophy in one person, and appointed Professor Ducatel, of the University of Maryland, to take charge of them. With the talents and acquirements of this gentleman, the Board have every reason to be satisfied, and in their opinion on this subject, they are fully supported by the numerous audience which attended his lectures during the last winter. He will now lecture four times a week, twice on chemistry, and twice on natural philosophy. The Board have reason to believe that the remaining evenings of each week will be filled by occasional lectures from gentlemen of acknowledged ability, upon interesting subjects, so that the lecture room of the Institute, during the four winter months, will present a place of resort of the most agreeable and instructive character, where information and amusement may be readily and cheaply obtained. Mr. Smith will again open the drawing school, and when his own abilities, and the excellent collection of models of the Institute are considered, it is hoped that his class will be as numerous as the importance of the subject of his instruction ought to lead us to anticipate.

The contribution to entitle a person to the privilege of membership, is still three dollars, for which all the advantages of the Institute, except the drawing school, are obtained.

Connected with the Institute, is the Apprentices' Library, containing a numerous collection of works peculiarly adapted for the members of this Institution, and which the Board have now made arrangements to put in active circulation.

The Board of Managers confidently hope, that the Institution which has thus far existed, and added its portion of useful duty to the public, will still receive a general, liberal, and willing support.

J. I. Cohen, Jr. *Chairman.*

On the Making of Charcoal.

The subjoined notice has been going the rounds of the European and American Journals, without a single remark in either of them, respecting the author of the improvement to which it refers.

"*Manufacture of Charcoal.*—A new process, recommended in the

Journal des Forêts for this purpose, is to fill all the interstices in the heap of wood to be charred, with powdered charcoal. The product obtained is equal in every respect to cylinder charcoal; and independent of its quality, the quantity obtained is very much greater than that obtained in the ordinary method. The charcoal used to fill the interstices, is that left on the earth after a previous burning. The effect is produced by preventing much of the access of air which occurs in the ordinary method. The volume of charcoal is increased a tenth, and its weight a fifth."

The discoverer of the foregoing method of making charcoal, was Mr. Marcus Bull, of Philadelphia. The process was published in the Franklin Journal, for June, 1826, vol. i. first series, p. 358. By the following extract it will be seen that the foregoing account, from the *Journal des Forêts*, is given nearly in the words of the original publication.

"In the paper of Mr. Bull on the subject of fuel, that gentleman has described his method of obtaining charcoal, by surrounding the pieces of wood to be charred, with pulverized coal, by which a product is afforded equal in every respect to that made in cylinders, or retorts of iron. The Editor has seen some of the charcoal made upon this plan, in the large way; its superiority to that produced by the common process was very striking. The plan proposed can be pursued with facility and without expense, and the great saving of wood from the increased quantity obtained, is a circumstance which renders it of national importance."

Mr. Bull says, "it occurred to me that an important improvement might be made in the common process of making charcoal, by filling the interstices between the sticks of wood, with the culm, or fine coal, left on the ground after the large coal has been drawn from the pit; and by covering the wood more perfectly than is usually done. In this way we may more completely prevent the access of air, which is not only destructive, in many cases, to a large portion of the coal, but also renders what remains less valuable."

"An intelligent collier in New Jersey applied, in a partial manner, the plan proposed. He found the product to be about 10 per cent. more in quantity, *by measure*, than he had ever before obtained from the same kind and quantity of wood; and I also found the coal when brought to market, nearly 20 per cent. heavier than usual."

[Editor.

Shell Lac and Seed Lac. Reply to Query.

By turning to page 102 of the Franklin Journal, vol. ii. first series, the subject of seed lac and shell lac, as applied to varnishes, will be found to be treated at some length. The manufacturing of sealing wax. The application of shell lac to the stiffening of hats, and various modes of bleaching this resin, have also been fully made known in this work. We wish that "Many Manufacturers" would purchase the volumes, and examine for themselves.

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

FEBRUARY, 1831.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN OCTOBER, 1830.

With Remarks and Exemplifications, by the Editor.

(Concluded from page 16.)

91. For improvements in *Machinery used in Steam Navigation;* Franklin G. Smith, Lynchburg, Campbell county, Virginia, October 12.

Plates to accompany the specification of this patent are in the hands of the engraver.

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92. For an improvement in the *Mould or Instrument for Pressing Pine Apple Cheese;* Myron Norton, Goshen, Litchfield county, Connecticut, October 13.

Instead of the netting usually employed to mark the lines upon plne apple cheese, moulds are to be made, of wood or metal, cast iron being preferred. Upon the insides of these moulds the requisite pattern is formed, by carving or otherwise. The moulds are made in three parts, and, when used, are confined together by proper bands. A tubular opening is left at the lower part of the mould, to fill it with curd, and into this a follower is fitted for the purpose of making pressure.

The claim is to "the substitution of the mould of metal, or wood, carved, or cast in manner and form described; and the manner or principle of giving the stamp or impression in the cheese by said

mould, at the time and in the process of pressing, thereby superseding, and eluding the use of the net formerly used for giving the impression."

Although we are impressed with the idea of having seen pine apple cheeses, the pattern of which had evidently been given by the form of the mould, we are not able to assert it as a fact. We, however, have seen many cheeses made in moulds in which devices had been carved; and they are quite common in some countries. The present patent, therefore, must stand upon the claim of the particular pattern of the mould, being that of a pine apple.

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93. For an improvement in the mode of *Constructing the Fancy Card of the Carding Machine;* Phineas L. King, of Sparta, and Enoch Blasdel, of Lawrenceburgh, Dearborn county, Indiana, October 14.

(See specification.)

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94. For a *Washing Machine;* John Freeman, Senate, Cayuga county, New York, October 14.

There is a trough into which the clothes are to be put. Within this trough are two carriages, placed side by side; the lower sides of the carriages are furnished with fluted rollers, and they are driven alternately backwards and forwards by means of a crank. The clothes being placed within the trough, the carriages are put in motion, and the action of the rollers is to produce the desired effect.

"I claim as my improvement, the principle, and the moveable carriages with fluted rollers, as new, and heretofore unknown and unused."

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95. For a *Revolving Steam Washer;* James Barnes, Kingston, Luzerne county, Pennsylvania, October 14.

This "Revolving Steam Washer" is a common barrel churn, with pins projecting through one of the staves into the barrel, to raise the clothes as the barrel revolves, and cause them to fall down into the suds. What constitutes it a *steam* washer, or what it possesses of novelty, would be news to us.

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96. For a *Machine for Sawing Felloes* for the wheels of carriages; Alvan Colbry, Sharon, Windsor county, Vermont, October 15.

Several patents have been taken for machines for sawing felloes. The present machine differs but little from some which have preceded it, and the only thing claimed as new, is the method of returning the carriage after the felloe is sawed. The plank to be sawed is placed upon a carriage, confined by a pin at the centre of the curvature of the felloe. There is a rack upon the lower side of

the carriage, and a pinion taking into this rack causes the carriage to advance; it is made to return by throwing this pinion out of, and another which operates in the reversed direction, in gear; a kind of movement common in machinery.

It frequently happens that after examining the papers and models in the patent office, applicants for patents find that they have been anticipated in their inventions, and therefore omit a part of the claims they had intended to make. We do not know that this was the case in the present instance, but from the smallness of the pretensions set up, it might fairly be inferred. The general principle of the machine has been so long known, as to have become public property.

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97. For an improvement in the *Saw Set;* Ebenezer Whiting, Berkshire, Tioga county, New York, October 15.

(See specification.)

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98. For a *Machine for Spreading Lime, Plaster, &c. on Land;* Andrew Krauss and Joel Krauss, Upper Milford, Lehigh county, Pennsylvania, October 16.

The lime, or plaster, in powder, is put into a wagon constructed for the purpose. Across the hinder part of the bed of the wagon, near the tail board, there is an opening extending from side to side. A roller fixed upon gudgeons, below the wagon bed, nearly fills up this opening. On the end of the axle of one of the hind wheels a pulley is placed, from which a band extends to another pulley on the axis of the roller, to cause it to revolve; the axis of the hind wheels revolves with them, for the purpose of communicating this motion. As the roller turns, it draws after it a portion of the article to be spread upon the land. The claim is to "the machine as above described, for spreading lime, plaster, &c. on land."

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99. For a *Machine for Washing Clothes;* William H. Brainard, of Haddam, and Chauncey B. Bulkley, of Chatham, Middlesex county, Connecticut, October 16.

A trough is made to contain the articles to be washed; dashers are caused to vibrate in this trough, by means of two levers, worked like pump handles, one in each hand. The specification contains about as many pages as we have devoted lines to the description; we, however, will afford room to the claim, which is as follows.

"What we claim as new in the above described machine, is the arrangement of the various parts which constitute the same, in the manner above specified, and the application thereof, and of the powers and principles embraced in the operation of said machine, in the form and method above set forth, for the purpose of washing clothes."

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100. For an improvement in the *Production of Light*, by a combination of liquids; Isaiah Jennings, City of New York, October 16.

This patent is taken for a material which is to be substituted for

oil in common lamps. The material is a mixture of alcohol and spirits of turpentine.

"To produce light from alcohol and spirits of turpentine, mix equal or unequal parts of each, agitate them that they may mix together; let them stand awhile, and the alcohol will be combined with a small quantity of turpentine, and the remainder will be separated; draw off the alcohol, and the small portion of turpentine combined, which is about one-eighth part, and it will be ready for use.

"I claim the admixture of alcohol with spirits of turpentine, and its application to common lamps, with or without wicks."

We have seen the above mixture in combustion in an Argand's lamp. The flame was clear, dense, and brilliant. The light may be made greatly to exceed that from oil, without the escape of any smoke; and there is not the slightest odour of the turpentine. The patentee says the mixture is as cheap as spermaceti oil, and that he is making arrangements which will enable him to afford it at a cost considerably below that material. The wick is scarcely blackened by the combustion; there is no dripping from the lamp, and no grease.

Chemists knew the fact that alcohol and spirits of turpentine would combine, and burn with a bright light; but we are not aware of their having been proposed to form an article for the supply of lamps, and one which might be advantageously employed in domestic economy. The patentee has used this composition with a wire wick, and has found it to answer well. Fibrous asbestos would probably be preferable, but this is a point of mere curiosity, as cotton wick is always at hand, and none better need be desired.

The friends of temperance will not object to the burning of alcohol.

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101. For an improvement in the *Grist Mill;* Ephraim Griswold, Truxton, Courtland county, New York, October 16.

The runner of this mill is made conical, something like the common steel mill. This is to fit into a hollow conical piece, which forms the bed. The runner and bed are to be made altogether of stone, or they may be formed in part of cast iron, with pieces of burr stone fastened on them by screws.

The axis of the runner is placed horizontally, and an opening is made through the side of the hollow conical piece, to feed the mill stones. This opening is near the inner, or small end, of the cone; the termination of which is not to be in a point, but in a segment of a globe.

"The invention here claimed is the general construction of the mill as above described; particularly in the manner of making the runner and bed of stone, or of burr blocks screwed on cast iron for that purpose."

The general construction is not new. The conical form, the feeding in the manner described, and the making such mills of stone, are circumstances in all of which the present patentee has been anticipated. What he more particularly claims, the screwing of burr blocks to iron, is, we apprehend, the only point of novelty.

102. For an improvement in the mode of making *Glass Door Knobs;* Deming Jarvis, Boston, Massachusetts, October 19.

These knobs are perforated in the usual way, to receive the spindle, which is to be square. A square cavity, about a quarter of an inch deep is sunk at each end of the knob, to receive a square collet, which will prevent the knob from turning. In all other respects the knob is made in the common form.

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103. For an improvement in the *Manufacture of Oil from the Sun Flower;* Charles A. Barnitz, Spring Garden, York county, Pennsylvania, October 20.

This *improvement* consists in following the old mode of hulling, breaking, and pressing seeds to obtain their oil. There is not the slightest pretension to novelty, but it is presumed that the patentee simply means to secure to himself the right of doing that which is known all over the country, and has been practised both here and in Europe.

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104. For an improvement in the manner of *Manufacturing Brads from Iron Plates;* Edmund Gamman, Gorham, Cumberland county, Maine, October 20.

A strong iron shaft is to have projecting rims upon it, around which rims are placed steel cutters, in number from six to twenty. The cutters are tapered in reversed directions, alternately, according to the taper of the brad. The stationary, or bed cutters, are to be made to vibrate by means of cams. The particular construction of this part of the machine does not appear in the drawing, and is very obscurely described in the specification. The iron plates are to be carried towards the cutters by feed rollers.

The whole machine appears to be considered as "the improvement," as there is no particular claim to any part. Circular brad and nail machines, with the revolving cutters fixed in the manner described, have been repeatedly tried; they have not however been found equal to the ordinary vibrating machine, nor do we believe they can be made so.

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105. For a combination of machinery for *Thrashing Grain, Shelling Corn, Cutting Straw, and Grinding Provender;* Benjamin D. Beecher, Woodbury, Litchfield county, Connecticut, October 20.

This is a sort of *omnium* machine, the novelty of which consists in uniting several different machines together.

The claims made are to "the particular form of the beaters; the manner of making the concave; driving the feeding roller by the main band; the apron by the main shaft; and the mode of combining the several pieces of the machinery."

The cylinder has iron beaters on it which are bent in the form of a V; that, in beating, the angular point may first meet the grain to be

thrashed; the hollow segment, or concave, is formed of thin plates of iron, placed between strips of wood. The shelling part is made like the well known corn sheller, consisting of a circular disk with teeth on its side. Towards the centre of this wheel cutters are placed, for cutting straw; when thus used, a trough is added to feed from. Still nearer the centre is to be a furrowed, cast iron plate, running against a corresponding plate, for grinding provender. We have heard of instruments furnished with so many conveniences that it was quite inconvenient to use them; this objection, we suspect, will lie against the contrivance of which we have spoken, and it will not stand alone, as "the *particular* form of the beaters," and some other *particulars* named, are by no means new.

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106. For a machine for *Sawing Felloes for Carriage Wheels;* David D. Hanson, Weare, Hillsborough county, New Hampshire, October 20.

This machine bears a strong resemblance to that described, No. 96. There is, of course, some difference in the arrangement. The improvements claimed are the manner in which the part called the sweep is constructed, together with the vice and gauge pullies. These particular parts we do not think it necessary to describe, not perceiving any thing in them worthy of special notice.

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107. For an improvement in the *Water Wheel;* Henry Overvill, Richland, Oswego county, New York, October 21.

This water wheel is similar to one which we described in our last volume. The leaves, or buckets, are hung like shutters, and are intended to open by the force of the current, when moving with it, and to close in their opposite motion. Such buckets, variously hung, have been reinvented over and over again. The contrivance is one of the first suggestions to the minds of those who are in search of a current wheel, and who are uninformed respecting previous failures in the same search. The phantom is destined to be again called from the shades, and again to disappoint the exorist.

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108. For an improvement in the machine for *Carding Wool,* and other fibrous materials; Calvin Wing, Gardiner, Kennebeck county, Maine, October 21.

This carding machine has been fairly tested, and is highly spoken of, both as regards the goodness of the work performed by it, and the saving of labour, which is said to be equal to more than one-half. We cannot describe its various arrangements, intelligibly, without a plate, and therefore will not attempt it, particularly as we may hereafter be enabled to give it with the requisite illustrations.

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109. For an improvement in the *Water Wheel, by Casting it in one entire piece; and also in the mode of Casting the*

same; Calvin Wing, Gardiner, Kennebeck county, Maine, October 22.

(See specification.)

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110. For an improvement in the *Mode of Boring the Earth for Water,* and for other purposes; William Morris, Jr. and Jabez Spinks, Kenhawa county, Virginia, October 22.

The principal object of this machine, we are told, is the employment of horse power, which is applied as in the common horse mill. The horse being geared to a sweep attached to a vertical shaft.

Over the well, or place to be bored, a scaffolding is raised consisting of four poles 40 or 50 feet in length, and placed rectangularly, suitable cross pieces being used to bind them together. The drill is made to rise and fall by means of a horizontal shaft acted upon by the periphery of the horizontal wheel, turned by the horse; and by means of a rope passing over a pulley at the upper part of the scaffold, the auger may be withdrawn.

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111. For improvements in the construction of the *Water Wheel,* and in its application to the driving of machinery, by the reaction of water; Calvin Wing, Gardiner, Maine, October 22.

(See specification.)

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112. For a *Bedstead, called a Metamorphosic Alleviator;* Jonathan Lowe, Vienna, Oneida county, New York, October 25.

This is one member added to the family of bedsteads designed for the accommodation of persons confined to bed. We have recently noticed two patents, having the same object in view, and a volume might be filled with descriptions of similar contrivances. In the case before us, the platform, or bottom of the bedstead, is divided into three parts; the head part is made to elevate, and the foot part may be depressed, there being joints in the side rails for that purpose. The legs, at the foot, are made capable of bending underneath to allow of this depression. The centre part of the side rail is furnished with legs, independent of the head and foot posts, to sustain the bedstead when the latter are off the floor. Rollers, ropes, pullies, &c. are used to give the required elevation or depression.

There are so many ways of effecting the purposes intended by this bedstead, and they have, indeed, been so frequently effected, that there ought to be something special in the construction of an apparatus of the kind for which a patent is taken. The present patentee appears to consider as new, all that he describes, as if there is any thing which can be called a claim, it is in the following words.

"For all which improvement in the construction and use of the common, French, field, high post, and other bedstead, the inventor most respectfully solicits the patronage of the proper authorities, by granting him letters patent, agreeably to the acts of congress in such case made and provided."

113. For an improvement in the *Machine for Inking Forms of Type,* or letters, &c. when worked, or printed on a common hand printing press; Samuel Fairlamb, City of New York, October 25.

The patentee has occupied eleven pages in the description of his apparatus, with an additional page of references to the drawing. The claim is of considerable length, and would not be understood if given alone. Since the patent obtained by Mr. W. J. Stone, in Oct. 1829, three or four differently constructed inking machines have been patented, which have been duly noticed. The present is less complex than some of its predecessors, but it has no superiority in this particular over that of Mr. Stone. The only true test of comparative merit, is a fair trial, which has not yet been given to Mr. Stone's machine.

LIST OF PATENTS WHICH ISSUED IN NOVEMBER, 1830.

With Remarks and Exemplifications, by the Editor.

1. For a *Machine to Pick up Apples from the Ground,* under the trees; Samuel Laning, Camden, Gloucester county, New Jersey, November 1.

This machine is to be driven on by handles formed like those of a wheel barrow. A drum, or cylinder, stands in the place of the wheel, extending across the machinery, and being about 16 inches long. The heads of this cylinder form projecting rims extending three inches beyond the cylinder; these rims serve as wheels to the picking machine, and sustain the cylinder at the distance of three inches from the ground. Pointed wires serve as pickers, by running into the apples. A comb above the cylinder removes the apples from the pickers, and conducts them down into a basket suspended to receive them, which, when filled, is to be replaced.

The claim is to "the employment of a cylinder with pickers for the purpose of picking up apples from the ground, and the comb, or slats, for taking the same from the pickers, and delivering them into a basket, in the manner, and for the purposes herein described."

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2. For an improvement in the *Apparatus for Boring the Earth for Water;* Levi Disbrow, City of New York, November 1.

(See specification.)

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3. For a *Machine for Cutting Tenons on Carriage and Wagon Spokes;* Andrew P. Smith, Cornwall, Litchfield county, Connecticut, November 1.

The patentee has described this machine at much length, so that we think the description is obscured by its minuteness. The tenons it appears are to be cut by a jointer furnished with an askew iron. The shoulder is to be cut by a saw extending from the angle of the

jointer a little above the face of the iron. The jointer is made to traverse between horizontal cheeks, by a crank and pitman at one end of the frame. There are certain other appendages to hold the spoke, and regulate the cutting. The mode of operation differs from that of several other machines for the same purpose, but we do not perceive its points of superiority. The whole apparatus is patented, no claim being made.

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4. For an improvement in the *Lever Press;* Hazard Sherman, Scriba, Oswego county, New York, November 1.

This press acts upon the familiar principle of a combination of levers. There is a bed piece, or sill, from the ends of which rise two uprights with slots and holes to fix the ends of the levers, and form their fulcra. The patentee says, "what I claim as new, and as my own invention and discovery in this press, and for which I now ask an exclusive privilege, is the particular method of applying the increased power obtained by the multiplication of levers bearing upon each other, as described in the above specification, and illustrated in the drawing."

We are quite unable to ascertain in what the discovery here claimed consists; but we think there would have been just as much wisdom in claiming the *increased friction*, as the *increased power.*

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5. For an improvement in the *Machinery for taking the Wool from the Wool Carding Machine;* Charles Atwood, Middletown, Middlesex county, Connecticut, November 1.

"This improvement consists in placing a trumpet formed tube, having a rotary motion, at or near the end of the doffer, at each end of a wide machine, or one end of a narrow one, at a distance of about two inches from the face of the doffer, with its centre about level with the lowest action of the comb, at right angles with the doffer. The tubes turn into stands bolted on the top of the plate of the carding machine, projecting inwards, and are motioned as hereafter described. When the wool by the natural action of the comb has formed a roll of sufficient size for a sliver, or thread, the out end is passed through the tube, to a pair of rollers placed before it, having a speed sufficient to take it away. The lower of these rolls is on a shaft passing across the carding machine, having its bearings cut into the top of the plates, with two rolls on it of about four inches in diameter, and six inches long, placed directly before each tube, with their upper surface level with the centre."

We have copied so much of the specification to afford a general idea of the plan pursued; and can do no more without giving the whole with the drawings. The latter are but very indifferently executed, but still suffice to make known the *general* arrangement of the machinery.

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6. For an improvement in the *Machine for Winding the Slubbing, or Roving made from the Carding Machine, upon*

separate Spools, or Bobbins without Heads, called the Conical Spool Winder, for slubbing from the card; Charles Atwood, Middletown, Middlesex county, Connecticut, November 1.

We cannot attempt a description of this machinery, without giving drawings; nor can we furnish the claim of the patentee, as he does not make any.

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7. For a *Method of Moulding and Drying Brick;* Charles Vasser, Poughkeepsie, Dutchess county, New York, November 1.

The brick moulds are to have projecting edges of steel, and the stock is to be of metal, or covered with metal. Each brick when moulded is to be turned out upon a smooth board, a little larger than the face of the brick. These boards, with the bricks upon them, are to be arranged upon shelves in a drying shed. The roof of this shed is to be close, and the sides furnished with falling shutters to keep out the rain, &c. when required.

The foregoing is the substance of "Vasser's new and useful invention for moulding and drying bricks." There is no claim. We are not quite sure that moulds lined, as we have seen them, with iron, are not as good as those above described. Sheds with close roofs and side shutters are not new, and would be generally used were not economy too much considered. The plan of a separate board upon which to dry every brick, we suppose is new, but doubt its adoption.

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8. For an improvement in the *Plough;* Samson Felton, Huntington, Huntington county, Pennsylvania, November 1.

No attempt is made in the specification to designate any thing in the form of this plough, that is different from that of other ploughs; but the mould board and land side are to be in part of cast iron, and in part of wood. The share is to be of wrought, or of cast iron. The claim rests upon these circumstances, and upon the manner of putting the whole together.

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9. For a machine for *Thrashing Grain and Shelling Corn;* Edward Thurston, City of New York, November 1.

This machine is to have a cast iron cylinder, which is to be fluted, or ribbed, from end to end. There is also to be a hollow segment similarly fluted. This hollow segment is to be borne up against the roller by spiral, or other, springs, and is fixed upon a frame, to which a weight is hung, to co-operate with the action of the springs. The claim is to the combination of the balance and spring bed, and to the entire cast iron cylinder.

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10. For a mode of *Preserving Rope and Cordage;* Amos Salisbury, Troy, New York, November 1.

If we understand this patent, tarred ropes must no longer be made without first acquiring a right from the above named gentleman.

He says, "my improvement consists in saturating the rope or cordage, or the material of which it is made, with oil, fat, or other *unctuous substance*, or applying such quantity of oil, or unctuous substance, as shall be deemed necessary to answer the purpose intended."

It will behoove Mr. Converse, the townsman of the patentee, to see that, in his candle factory, the workmen in his employ keep clean hands, or he may be fined for having his ropes saturated with tallow.

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11. For a *Machine for Facilitating the Washing of Ores and Alluvial Soils,* and the extraction of metallic substances and precious stones from ores, earth, sand, or other matter in which they may be found. Issued according to a special act of congress, passed May 28th, 1830, to Vincent de Rivafinole, late of England, but now of Mechlenburg county, North Carolina, for himself, and as attorney in fact for Charles Harsleben and William Davis, of the kingdom of Great Britain, November 1, 1830.

We have seen this machine in actual operation, and on a former occasion adverted to it in terms of commendation.

The apparatus consists of a conical tub, or other suitable vessel, placed vertically. A double shaft passes down the centre of the tub, which carries metallic dashers, or agitators, which are turned by means of a crank. The shaft is made double, consisting of a solid rod turning in a tube, to carry two sets of dashers with different velocities. The pulverized mass intended to be washed, is put into the tub, with some water. On turning the dashers with a proper velocity, the water will be thrown towards the outside of the tub, and the contents will assume the form of an inverted cone, to the lower end of which gold, silver, or other weighty articles will descend. There is under the centre of the tub, a metallic chamber, and a valve, which, when opened by means of a lever, will allow the heavy substances to descend into the chamber, and upon opening a second valve, they will fall from this chamber into any vessel placed below it.

When the agitation has been continued a sufficient length of time, the valve is opened, but the agitators are still kept at work. The chamber fills with a portion of water and with the heavy substances; the valve is immediately closed, and the contents of the chamber taken out; when the metallic or other ponderous matter which the earth contained, will be found therein.

The claim is to the double agitators, and to double or treble valves, to allow the washed materials to be collected.

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12. For *Lock Paddle Wheels,* for propelling canal and other boats; H. L. B. Lewis, Buffaloe, Erie county, New York, November 2.

The paddle wheels described in Mr. Lewis' specification, are to have the buckets hinged. The shaft, or middle part of the wheel is

to be a cylinder, or drum, to which the rims of the wheels are to be attached, leaving no place for the escape of water, either at the sides or towards the centre of the wheel. In order to enable the buckets to fill with water, a space is left, between each bucket and the cylindrical drum, just sufficient to allow of the escape of air, for that purpose. The gudgeons upon which the buckets turn, are to pass through the sides, or rims of the wheels; and arms, from them, work in grooves attached to the framing, or are operated upon by cams, or pins, to cause the buckets to lock and unlock, close or open, at the moment desired, and to assume an angle which may be thought best.

The claim is to "the locking or unlocking of the floats at any point required;" to the forming of the wheel with a cylinder, or drum, as described, with solid or close sides to prevent the escape of water, either laterally or vertically; and to the edges or rims of the wheels projecting beyond the outer edges of the paddles, for the purpose of checking, or preventing the agitation of the water, in order to prevent the banks of canals from washing.

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13. For a *Sawing and Planing Machine;* Thomas Bloomer, City of New York, November 3.

This may be a very good machine, but it is not explained with sufficient clearness to enable us to determine this point. A plane, of the ordinary construction it seems, is to slide between cheeks, or guides; a crank, with a pitman, or shackle bar, being employed to give it motion. It is intended to plane up short stuff for boxes, &c. There is a feed roller which is to move the pieces to be planed.

Saws of the circular kind, we are told, may be driven by the same machinery. The claim is to "the construction and application of machinery in cross cutting and planing boards for boxes and other purposes." The sawing apparatus is represented in a separate drawing, but is not described in such a way as to enable us to judge of what is intended to be claimed, as it consists of circular saws moved in the ordinary way, the frame work being so arranged as to adapt it to the purposes to which it is to be applied.

[TO BE CONTINUED.]

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for an improvement in the mode of constructing the Fancy Card used in Wool Carding Machines. Granted to PHINEAS L. KING, *of Sparta, and* ENOCH BLASDEL, *of Lawrenceburgh, Dearborn county, Indiana, October 14th,* 1830.

THE carding machine to which this improvement is applied, is constructed in every respect like those in common use. The improvement which we claim as our invention, is in the *Fancy Card* for cleaning the main cylinder and doffer. Instead of the usual fancy card, (which is of short wire,) the one we have invented and applied to use, is made of needles, or long, steel, pointed wire teeth,

properly secured in leather, behind, by wire, or any other suitable substance.

Our fancy card, constructed of needles, or long, steel, pointed wire teeth, not only does the business of the common fancy card in a superior manner, but it cleans the main cylinder and doffer, without wearing the cards, like the common fancy card.

This improvement can be applied to all wool carding machines.

The *invention* here claimed, is that of making fancy cards, (as before described,) of needles, or long, steel, pointed wire teeth, or long teeth made of common wire properly secured, instead of the short toothed fancy cards, now in use. PHINEAS L. KING.
ENOCH BLASDEL.

Specification of a patent for the making of Reaction Water Wheels entire, of one single piece of cast metal; and the mode of forming the pattern so as to accomplish this end. Granted to CALVIN WING, *Gardiner, Maine, October 22,* 1830.

To all whom it may concern, be it known, that I, Calvin Wing, have invented a water wheel, the two rims, or ends of which, with the floats or buckets, consist of one entire piece of cast iron, or other metal; and also a mode of casting the same, as well as other wheels intended to be moved by the reaction of water. The construction of the wheel invented by me, is fully described in an instrument of writing deposited in the patent office of the United States, for the purpose of obtaining a patent for the manner of constructing the same, and for the mode of applying it to various uses. And I do hereby declare that the following is a full and exact description of the manner in which the pattern of my said wheel is made and moulded, in order to its being cast in one entire piece.

I cause a flask to be made in three parts; the depth from the top to the bottom of the middle section of the flask being equal to the width of the floats, or buckets, between the rims, or ends of the wheel. In moulding the wheel, the pattern of one of its ends is placed upon the mould board, with its inner side downwards, that which I call its open end should be preferred; one of the exterior parts of the flask is then placed over it, and filled with sand in the usual way. It is then turned up and the centre part of the flask placed over it. The patterns of the floats are then properly arranged around the moulded end, the patterns being prepared with dowels, or pins for that purpose. When this part of the flask has been filled with the casting sand, the pattern forming the other end of the wheel is laid upon the floats, and moulded in the third part of the flask.

When the moulding has been thus completed, in withdrawing the pattern, the upper part of the flask is removed, the pattern taken out of it, and those of the floats also removed from the middle of the flask; the end of the flask is then replaced, and the whole mould

reversed, when the end first moulded is taken out. On replacing the end flask, the whole is ready for receiving the metal.

As in my reaction wheel the whole force to which it is subjected is sustained by one of its heads, through the centre of which the shaft passes, whether the same be used vertically, or horizontally, it is necessary to give considerable strength to that head, or end. But were this done by making the pattern of such head of the required thickness, there would be great danger of the cracking of the metal from unequal contraction in cooling, I therefore cast a centre piece, or hub, separately from the wheel, and secure it thereto by suitable bolts or screws.

What I claim as my invention, is the making reaction wheels entire, of one single piece of cast metal, and also the forming the pattern of my reaction wheel, so that the floats and the two heads may be moulded in a flask divided into three sections, in the manner, or upon the principle hereinbefore described, by which the same, or other wheels intended to operate as reaction wheels, may be cast in one entire piece. CALVIN WING.

Specification of a patent for an improvement in the construction of the Water Wheel, and in its application to the driving of machinery, by the reaction of water. Granted to CALVIN WING, *Gardiner, Maine, October* 22, 1830.

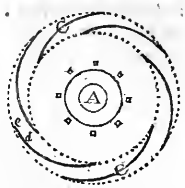
To all whom it may concern, be it known, that I, Calvin Wing, have invented or discovered certain improvements in the construction of the water wheel for driving machinery by the reaction of water, and in the manner of applying the same, either to vertical or to horizontal shafts, and also in the application of water thereto, by which inventions or discoveries, the difficulties hitherto experienced in the construction of that kind of mill usually denominated Barker's mill, and the various modifications of the principle upon which it acts, which have been hitherto essayed, are so far obviated, as to render the same more economical and efficient than the ordinary modes of applying the power of water as a motive force. And I do hereby declare that the following is a full and exact description of my said improvements, reference being had to the drawings which accompany this specification.

The water wheel which I use is generally cast in one entire piece, in the manner described in a certain instrument of writing, deposited by me in the patent office of the United States, for the purpose of obtaining a patent for making the same of one entire piece, and for the manner in which this is effected. The wheel, however, may be made in separate parts, either of wrought or cast iron, or any other suitable material.

Fig. 1, is a bird's eye view of the wheel, the end to which the shaft is to be attached, at the perforation, A, being downwards, and the open end, or rim, upwards. To show the floats, the upper rim, which covers them, is not represented. The lines, C, C, ex-

hibit the form of the floats, or buckets, and the manner in which they are arranged. The diameter of this wheel, and the width of the floats between the two heads, and the depth of aperture between the floats, will, of course, be varied, according to the quantity and head of water which can be obtained, and the purpose to which it is to be applied. The curved floats, it will be seen, are made to lap over each other; and, in practice, I have found that the proportion in which they do so is a point of considerable importance. The proportion between the aperture and the lap which I have found to be the best, is as three to two; that is, for every inch of aperture, measuring from float to float, at the point where the water escapes, the floats should pass each other one and a half inch. It will be manifest that a slight deviation from this proportion, in either way, will not be attended by any sensible loss of power. I have found, however, that any considerable deviation is injurious. The mechanic should be careful so to construct his wheel that the part of the aperture seen at *e* should be less than that seen at *d*.

Fig. 1.



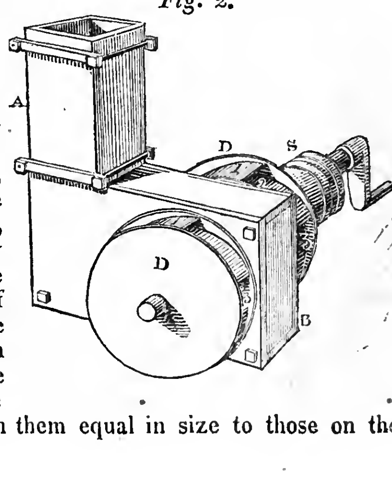
Upon the inner edge of the rim there is a projecting fillet, or flanch, which may be seen in the section D, of this wheel, at the lower part of Fig. 3, with this difference, that said fillets or flanches are to be made flat, as they are to work against, and not within, each other.

What I claim in the construction of the above described wheel, is the arrangement of the floats, or buckets, within the narrow rim forming the open head of the wheel, and their passing, or lapping over each other, in the manner described, by which the water is delivered tangentially from the wheel, or nearly so, whilst it is subjected to but little friction, or obstruction from other causes.

Wheels so constructed I apply either on a horizontal or vertical shaft, and either singly or in pairs, according to circumstances.

Fig. 2, represents the double reacting wheel, placed on a horizontal shaft, in which manner I use them whenever it is desirable to obtain motion from such a shaft. S, is the horizontal shaft, A, the penstock, and B, the cistern, the heads, or sides of the cistern, are formed in whole, or in part, of cast iron plates, securely bolted together. D, D, are two water wheels, one of which is placed on each side of the cistern, B, their open ends standing against the side plates of the cistern, which are perforated, having openings in them equal in size to those on the

Fig. 2.



heads of the wheels, and being concentric with them. The fillet, or flanch, upon the rim of each wheel, is made flat, and is fitted to run as closely to a similar fillet or flanch on the cistern head as may be, without actually bearing against it, so as to prevent too much waste of water, and yet to avoid friction by touching it.

The size of the orifices in the wheel and cistern plates is a point of essential importance, and should greatly exceed what has been heretofore thought necessary. Their area should be such as to permit the whole column of water to act unobstructedly on the wheel, whatever may be the height of the head. I have found that for a head of four feet, the area of the orifice should never be permitted to fall short of three times the number of square inches which can be delivered by all the openings of the floats. The penstock, or gate way, should also be sufficiently large to admit freely the same proportionate quantity of water through every part of its section; say about three times the area of the orifices of the cistern heads and wheels.

For a greater head these openings must be proportionally increased, or the whole intention will be defeated, as it has been from want of attention to this principle, that numerous failures have occurred in the attempt to drive mills by reaction wheels. Whenever it is practicable, the limit which I have given should be exceeded, but never can be diminished without loss.

Instead of using a trunk, or penstock, smaller than the horizontal section of the cistern, B, I extend the sides, front, and back of said cistern, upwards in one continued line, whenever the same can be done; the cistern and penstock then form one trunk, of equal section throughout.

When greater power is requisite, I place other reacting wheels, or pairs of wheels, upon the same shaft, so that each may operate in the same way.

What I claim as new in the foregoing modification of my invention, as represented in Fig. 2, is the placing of two or more of my reaction wheels against reservoirs, or cisterns, formed of plates of cast iron, or other suitable substance, in the manner, and for the purposes above designated. I also claim as my improvement the enlargement of the channels for supplying water to the buckets or floats, in the proportion, or exceeding the proportion which I have designated. The latter claim, however, not being confined to this particular modification, but appertaining to my wheel, in all its applications.

Fig. 3.

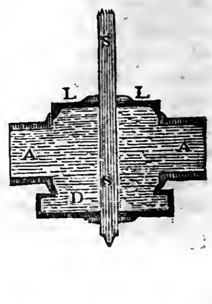


Fig. 3, represents one of my reacting wheels, placed upon a vertical shaft, with the cistern by which it is supplied with water; to this is also attached what I denominate *the lighter*, which is intended to relieve the lower gudgeon and step, from the pressure of the column of water, and also, when desired, the weight of the wheel, and whatever is attached thereto. The whole being shown in a vertical section through the axis of the wheel.

A, A, is the cistern of water, the construction of which, with its penstock, may be seen at B, A, Fig. 4.

D, the wheel, the flanch on its upper side passing within the edge of that on the lower plate of the cistern.

L, L, the *lighter* for relieving the gudgeon and step of the shaft and wheel from the downward pressure.

The lighter is a circular plate of iron, concentric with the wheel, and attached to the same shaft. Upon its lower side is a flanch, or projecting rim, fitting into an orifice in the upper plate of the cistern, in the same manner in which that of the wheel fits into the lower plate; allowing, therefore, of a vertical motion of the shaft to a certain extent, without binding upon the plates of the cistern.

From the equable pressure of fluids in all directions, the lighter, (when equal in its area to that of the orifice of the wheel,) will be pressed upwards with the same degree of force with which the latter, (the wheel,) is pressed downwards; and if made larger, it will be pressed upwards with a greater force; and may be so proportioned as to take off the weight both of the machinery and of the water, from the gudgeon and its step.

When a single wheel is placed upon a horizontal shaft, the lighter will take the place of the second wheel, and so also in the case of any odd number of wheels, either on a vertical or a horizontal shaft.

What I claim of the foregoing, in addition to my former claims, is the application of the lighter for taking off the downward pressure when the wheel, or wheels, are placed on a vertical shaft; and for equalising the lateral pressure when placed upon a horizontal shaft.

Fig. 4.

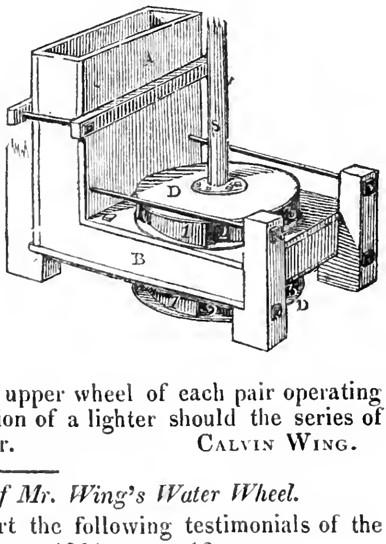


Fig. 4, represents the double reacting wheel on a vertical shaft. A, being the penstock. B, the cistern. D, D, the wheels, revolving within the plates of the cistern in the same manner as the wheel and lighter in Fig. 3.

The upper wheel in this arrangement answers all the purposes of the lighter in the former, the orifice of which may be enlarged, if desired, with the same views.

What I claim in this last modification of my invention, is, the placing of two or more wheels on a vertical shaft; the upper wheel of each pair operating as a lighter; but with the addition of a lighter should the series of wheels consist of an odd number. CALVIN WING.

Testimonials in favour of Mr. Wing's Water Wheel.

It affords us pleasure to insert the following testimonials of the

operation of Mr. Wing's water wheel. We have always thought the employment of the reaction wheel a very wasteful mode of applying water, as it had proved to be so in all the forms under which we have ever known it tried. Mr. Wing, however, bids fair to prove that, under the arrangements adopted by him, it will conquer all prejudices, and establish itself in the good opinion of the public, upon the basis of its real merits.

Many other testimonials have been exhibited to us, from persons worthy of all credit, both from their judgment and standing; but as they all tend to establish the same facts, we do not think it necessary to insert them.

Extract of a Letter from Alexander S. Chadwick, Esq. to the Editor. Dated Gardiner, Maine, July 24, 1830.

"In pursuance of your advice contained in your favour of the 21st May, Mr. Wing has proceeded farther in his experiments on the reacting wheel. He has put a double wheel in operation for propelling a saw mill, which, under every disadvantage attending all new experiments, gives the best satisfaction to all competent judges, and more than realizes his expectations. I do not hesitate to say, that *in all cases* of saw mills, he can save *one-half* of the water now required; in *general cases, two-thirds*; and, *in some instances, three-fourths.* There are a vast number of water rights which have been abandoned as valueless, to which the application of this wheel will give a power equal to the medium power of mill sites in the country generally.

Mr. W. has succeeded in doing away every objection heretofore existing to the reaction wheel. By the application of the *lighter*, or by placing two, four, or any *even* number of wheels upon the same shaft, (the *lighter* being used where an *odd* number is required,) he procures an equilibrium of the pressure of the column of water, and thus reduces the amount of friction occasioned by the water, which, except in very small wheels, was an insuperable difficulty. By the enlargement of the orifice of the upper wheel, or of the lighter, even the incumbency of the wheel itself may be supported by the water, instead of by the step. This last is only to be obtained from the vertical shaft.

Another great difficulty with the reaction wheel, was *want of power.* This arose from the injudicious construction of the wheel, and it is a difficulty which Mr. W. has wholly obviated. His first object is to leave the orifice so large that the column of water shall not be disturbed by that portion which is permitted to escape. Secondly, so to direct the water, as that its escape shall be as near as possible at right angles with a line drawn through the centre of the wheel; the power of reaction operating upon the wheel in a direct line with the escape of the water. This is not perfectly attainable in the construction of the wheel alone; but when it operates under water, its motion produces its own natural vacuum, the surrounding water forming a circular, elastic wall, and serves to assist in di-

recting the water in a course rather *within a right angle* from the line drawn through the centre. This tends to throw the force of reaction rather *without the centre of the aperture extending, or lengthening, the natural lever of the wheel.* Hence, all the power which water is capable of giving is obtained.

The power of reaction always exceeds the power of percussion. This proposition will appear obvious from this elucidation; viz. the power of percussion can never exceed the whole amount of head and fall, lessened by all the friction of the aperture, through which the water escapes, and the atmosphere through which it passes. The power of reaction, rightly applied, is equal to all the head and fall, not decreased by the natural friction to be overcome in the passage of the water. In addition to this, in all other wheels, some part of the head and fall is necessarily lost. Here there is nothing lost.

My object in stating, so particularly, the merits of this wheel, is to prepare you, in some degree, to understand what Mr. W. claims as his improvement.

Abstract of Col. J. Conners' Certificate.

This may certify that I have carried on the lumber business in the town of Gardiner, for 29 years; have occupied the same saw mill with the old fashioned undershot water wheel. That I have now in operation one of Calvin Wing's improved reaction water wheels; have had an opportunity to test it thoroughly, and am satisfied that under the same head and fall it operates with equal power and speed, with less than one-half the water used by any other saw mill wheel that I have been acquainted with.

I have also used one of said Wing's reacting wheels in my clothing and carding mills, and I find by experience that the back water has no perceptible effect to retard the motion or lessen the power of the wheel, if the head is increased in the same ratio, and I give it as my opinion that said wheels are superior to any now in use.

JAMES CONNERS, Jr.

Gardiner, Maine, August 24, 1830.

George Shaw & Co.

This may certify that we have had in use a water wheel called a breast wheel, which drew on seventy-two square inches of water; that it failed to carry with sufficient speed the machinery which I had attached to it. I was induced to throw aside said wheel, and to put in its place one of Calvin Wing's double reacting water wheels, and I am satisfied that the same water will do more than double the work when used on said reacting wheel, that it would do on the breast wheel.

We have also a reacting wheel in use at our other works, and find it to answer the best purpose, and are of opinion that said wheels are preferable to any other wheels now in use.

GEORGE SHAW & CO.

Gardiner, August 25, 1830.

Specification of a patent for improvements in the apparatus for Boring the Earth for Water. Granted to Levi Disbrow, *City of New York, November* 2, 1830.

Mr. Disbrow has a former patent for boring apparatus. One particular object in the present patent, appears to be the employment of bits with springs attached to them, to cause them to bore a hole larger than that of the tube through which they are passed down. The parts described are as follows.

No. 1. *The pipes for sinking in the earth*, are of cast iron, of an equal bore throughout, but of a diminished thickness, taken from the outside near the end, till it is small enough to fit into the socket formed on the next length of pipe—the socket is formed by a band of wrought iron, placed on the end of the pipe, but which, when cold, contracts, and so remains permanent. The next length of pipe is formed in the same manner, and so may be continued to any required length or depth. The joints are closed as iron joints, by driving wedges, and so resist either water or steam.

No. 2. *The pod or cylinder bit for boring the earth*, passes through the pipe. It is made of iron, pointed with steel; there is a spring on the outside, whose most disengaged state is larger than the outside of the pipe, to the end that when it gets below the pipe, it may cause a hole to be bored larger than the pipe to be received; and which is effected by the distension caused by the spring.

No. 3. *The chain and levers for forcing down the pipe.* The levers are two pieces of joist made fast to the platform by pieces of chains, or other common means. The chains have hooks on either end. One hook fastens on the socket; the other is passed with the chain round the lever, and hooks in such part of the chain, as the purchase may require, at pleasure.

No. 4. *Rods connected by crutch joints and screws.* The rods are square lengths of iron; there is a square crutch formed at each end of the length, into which one admits the other. The ends are held by screws which pass each other transversely; by this means any length of rod may be securely connected, gaining the effect both of flexibility and strength.

No. 5. *The spring chisel* is formed by a spring which confines the operation of the chisel, or punch, to the edge of the pipe. Its use is for breaking off pieces of stone which in part obstruct the passage of the pipe.

No. 6. The rock boring tools are, first, a set of chisels, or punches; second, a riming bit. It is formed by four dies of steel well bolted on a square rod, which extends below as a guide; its use is to enlarge a hole already made to any proposed size. The whole of the above tools and apparatus are used with the machine already patented to said Levi Disbrow, dated twenty-fourth March, one thousand eight hundred and twenty-five. Levi Disbrow.

Observations on a patent obtained by Lieut. Bell, *for a Percussion Lock and Vent for Cannon; and an assertion of the original claim to that invention. By* Joshua Shaw.

Philadelphia, January 27, 1831.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Sir,—In the last December number, just received, is a notice of a patent granted to Lieut. W. H. Bell, for a percussion lock and vent for cannon. There never was a more striking instance of the natural propensity which one man has to disregard the rights of another, than is exhibited in the conduct of this gentleman, and in the use and application of the machine in question, which is not in any essential degree, or particular, different from one patented on the 24th day of October, 1828. You have observed that, excepting in the mere arrangement of the parts, *you do not think it new.* And again in speaking of the countersinking of the vent to receive the primer, which stands as conspicuously as any other part of the arrangement, you ask, *is this new.* Now it would extremely oblige one who is much interested in this matter, to be permitted to inquire if there be *any thing new* in this specification, or which did not originate with some other person, and which was not communicated to Lieut. Bell long previous to his application for a patent.

The author of these remarks was the first to discover the process of firing cannon by the means here employed, and the power of the fulminating matter to penetrate through the cavity of the vent, and to ignite the charge without the assistance of the priming wire, priming materials, or other priming powder, by the means of a machine acting upon it in precisely the same manner as in Lieut. Bell's apparatus, which is the same in principle with mine, without a single advantage being gained; except it be contended that the contracting of the vent, and the placing it on one side, constitute any; and if such be the case, the claim should be exclusively confined to them. However, it is doubtful if the first could be sustained, as a vent is only such, and has been drilled of every dimension, without any fixed rule. With respect to its location on the side, it is a very important point gained, where a lock of any kind is employed, whether it be on the percussion or the flint lock principle. But it is believed that Lieut. Bell never intended to claim these as his invention; they are, however, introduced, and that in a way very well calculated to serve a lame purpose, by qualifying a machine otherwise useless, as it would be impossible to apply it to the guns now in the United States' service. To have been consistent, this specification ought to have gone further, and have laid claim to the cannon also, since, if a mere change in the *arrangement* of the parts of a machine will suffice in the first case, it must apply with equal *certainty* in the second instance.

On first reading the account of Lieut. Bell's patent, I confess that I felt my indignation rising, and was disposed to be very angry; but

my charity for human failings has prevailed over the less kindly feelings of our nature, and has induced me to conclude that the Lieutenant did not comprehend the law on patents, and acted under the impression that the right of invention was a sort of debateable property, a something like waste lands, on which any person who felt disposed, might locate himself without asking any questions, break up the soil, and work it for his own purposes and benefit. If this be not the view taken of it by the gentleman, it will be impossible to account for his conduct in any other way, especially when the following particulars shall be made known. In 1828, or 1829, Lieut. Bell called on the subscriber for the purpose, as he said, of making inquiries respecting the various modes of preparing and applying the fulminating powders to the best advantage, as a priming for cannon. I communicated all that I knew, freely and unreservedly, and pointed out to him the various advantages and disadvantages attending its application, observing that the vents as now made were in general too large to apply it advantageously; that the reaction upon the cock at the moment of discharge was one of the principal objections, as it required the addition of a safety spring. This difficulty, I observed to him, could be easily removed, when new castings should be required, by merely drilling the vents of about half their present diameter, and that a further advantage could then be secured by making it on the side, which would free the sight. I then exhibited to Lieut. Bell one mode of doing this, not by mere explanation, but I produced and exhibited to him a working model complete, and which he examined carefully, and with manifest interest. He said it was excellent, and one of the most valuable improvements he had heard of. He expressed his surprise that I should be so ready to show it, and said that it could be taken advantage of to my prejudice. I told him that I did not think so, as I believed my specification covered the *principle*, and that with respect to the mere *arrangement* of the parts, the same thing could be done in many different ways; that the numerous guns in the American service were very differently formed at the breech, and required the *arrangements* to be varied accordingly, so as to render the invention applicable to them, and useful to the government; that so long as the principle was the same, any mere variation of form would be an invasion of my patent, especially where the change, or variation, was the consequence of necessity or convenience. He, perhaps, thought otherwise. I had also in my possession at the same time, a lock mounted on a skeleton cannon, with the vent contracted, and placed on the side of the vent field; this, if my recollection serves me, was standing in the room at the time; of this, however, I will not be certain, but it is certain that I described it, and some other modes, which I had reduced to practice. Of these facts, and the conversation which passed at the time, I have the most unimpeachable evidence.

Now as these observations involve something more than a mere statement of isolated facts, your attention to them by an insertion in the Journal of the Franklin Institute, will oblige one, at least, who has benefitted his country by the introduction of a valuable discovery,

(not a contrivance,) through years of expensive experimental labour, but whose lot it may be, like many others, to be deprived of his just reward. It is, however, to be hoped, that the time has come, when a simple change in the *arrangement* of the parts of a valuable instrument, will not entitle the speculator to a preference, and leave the original inventor destitute.

I am, sir, very respectfully,
your obedient servant,
JOSHUA SHAW,
Christian street, Philadelphia.

On Mr. M. SMITH'S *improvement in Compass Needles.*

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

City of Washington, February 10*th*, 1831.

SIR,—In the remarks which you appended to the specification of my patent for an improvement on surveyors' and mariners' compass needles, published in your last volume, p. 238, allow me to say that the remarks which you make on the theory upon which I have proceeded, are liable, and likely to prejudice the minds of most of your readers against the needle itself, or the improvement which I believe that I have made in it. The greater number of persons are incapable of abstracting the theory from the fact, and are apt to think that if the former is impugned, the latter must fall with it. I really have not the arrogance to pretend to form a theory upon subjects where those who are greatly my superiors in learning are at a loss. I am a mere practical man; the earlier period of my life was spent in the service of my country, in the revolutionary war; and since that time, I have been much engaged in practical surveying. This first led me to pay particular attention to the compass needle, and to a desire to remove some of those difficulties which often baffle the surveyor and the mariner, and not unfrequently endanger the safety of the latter. I think I have now, in the eve of my life, something to offer to my country, which will be found to be a valuable practical improvement. Leaving, therefore, the discussion of the theories to others, and abandoning every thing in my specification which is merely theoretical, I will merely ask you to state to the public the facts which I have recently exhibited to you, as I think by so doing you may do an essential service to society, and perhaps benefit an humble individual.

If I have done something more than other mere practical men, it may be fairly attributed to a degree of persevering industry, which has always kept my eyes open to those facts which have come under their notice, and a disposition to endeavour to turn them to advantage.

That you are as much a friend to truth as I am, and that it is your wish to disseminate it, I am fully convinced. You will, therefore, I am sure, insert this letter in the next number of your Journal, with

such other matter as you may think calculated to place my claims in their proper light.

Very respectfully, &c.

Moses Smith.

Remarks by the Editor.—After receiving the foregoing letter from Mr. Smith, we should think it not only unkind, but unjust, to say any thing further respecting the theory of what he calls his electric rods; and more particularly as we are convinced, from what we have ourselves seen, that Mr. Smith has actually made one important discovery as regards the magnetic needle. It is well known that from the firing of cannon, and violent concussions of other kinds, the magnetism of the compass needle, becomes deranged, or confused, in which state it will be generally found to have several, instead of only two poles; and its directive power is consequently destroyed. In the experiments exhibited to us by Mr. Smith, he took a needle, the directive power of which was perfect; he struck it a moderate blow at each end, longitudinally, and it became deranged; on striking it transversely on each side of its centre, its power was instantaneously, and *perfectly* restored: this he repeated several times. He then placed it upon a table, held it firmly down, in the manner described in his specification, and by striking the table, produced effects analogous to those which resulted from striking the needle itself. This instantaneous mode of restoring the magnetic power, which was new to us, may, it is manifest, be of incalculable importance, particularly at sea, where the safety of all on board a vessel frequently depends upon the good order of the compass needle. Mr. Smith avers, that in all cases of accidental disturbance of the magnetic power, his method is effectual, and he appeared to be borne out by his experiments. With respect to what he calls his feeders, he believes himself justified by long continued observation, in concluding that they protect the needle from foreign attractions, and increase its directive power. They are now in a fair way of being tested, as there are some of them on board of our ships of war. Mr. Hasler, whose judgment in such cases is well known to every man of science, is very favourably impressed with regard to their operation, and has given a testimonial to that effect; and several other gentlemen conversant with this subject, anticipate much advantage from Mr. Smith's inquiries.

FRANKLIN INSTITUTE.

Monthly Meeting.

The stated monthly meeting of the Institute was held at their Hall on Thursday evening, January 27, 1831.

Mr. Isaac B. Garrigues, was appointed chairman.

The minutes of the last meeting were read and approved.

The following donations were presented to the Institute, viz.

By Mr. A. B. Hutton.

Historical and Descriptive Anecdotes of the Steam Engine, and of their inventors and improvers, by Robert Stuart.

By Mr. John Ronaldson.

Elements of Natural Philosophy, by John Leslie, Esq. Vol. 1. (*including Mechanics and Hydrostatics.*)

By the Board of Managers of the Institute, for 1830.

Observations sur la Physique, sur l'Histoire Naturelle et sur les Arts, Vol. 1 *to* 27, *and* 32 *to* 40.

By C. C. Biddle, Esq.

A series of the National Gazette and Literary Register, from November, 1820, *to June* 30, 1830.

By Mr. A. Ramage.

A medal issued on the opening of the Liverpool and Manchester Rail-road.

By James Dundas, Esq.

A medal issued on the proclamation of William IV. king of Great Britain.

By Mr. James Harper.

The Report of the Managers of the Schuylkill Navigation Company, for 1830.

The corresponding secretary laid on the table the following works, received in exchange for the Journal of the Institute, viz.

Journal of the Philadelphia College of Pharmacy, Nos. 1, 2, 3, *Vol.* 2.

The Mechanics' Magazine, and Journal of Public Internal Improvements, for December.

London Journal of Arts and Sciences, for November and December.

The Register of Arts and Journal of Patent Inventions, for November and December.

The Repertory of Patent Inventions, for November and December.

Professor A. D. Bache, from the committee on explosions of steam engines, reported that the committee were progressing in their preparations for the experiments, and expected to be engaged in trying them previous to the next meeting of the Institute.

Mr. D. H. Mason called the attention of the meeting to the subject of the method of applying the power of steam engines to locomotive carriages, when, on motion, it was resolved, that the subject be placed on the minutes for discussion at the next meeting.

On motion, it was resolved, that a committee be appointed, whose duty shall be to keep a meteorological register, which shall be published monthly in the Journal of the Institute.

Mr. Reuben Haines, Professor A. D. Bache, Messrs. W. Keating, W. R. Johnson, and James P. Espy, were appointed the committee.

Adjourned.

Isaac B. Garrigues, *Chairman.*

James H. Bulkley, *Recording Secretary.*

Board of Managers.

A meeting of the Board of Managers of the Franklin Institute, was held at the Hall of the Institute, January 24, 1831.

James Ronaldson, president, in the chair.

The actuary read so much of the minutes of the annual meeting of the Institute, as related to the election of this Board, whereupon the Board went into an election for the officers of the Board for the ensuing year. Messrs. Samuel J. Robbins and Frederick Fraley, were appointed tellers, who having received the votes of the members, reported the result to the president, who declared the following gentlemen duly elected, viz.

M. D. Lewis, *Chairman.*

Samuel J. Robbins, } *Curators.*
Isaac Hays, M. D. }

The president having retired from the chair, Mr. Lewis took his seat as chairman, when, on motion, it was resolved, that the bye laws which governed the former Board, be adopted for the government of this Board, until annulled.

Resolved, that the committees appointed by the former Board, to try experiments on water wheels, and to inquire into the cause of the explosion of the boilers of steam engines be continued.

An adjourned meeting of the Board of Managers, was held at the Hall of the Institute, January 27, 1831.

M. D. Lewis, chairman.

The minutes of the last meeting were read and approved.

The chairman nominated the standing committees, in conformity to the regulations; which nomination, after adding Messrs. C. Gobrecht, James J. Rush, and W. R. Johnson to the committee on inventions, was approved by the Board as follows.

On Premiums and Exhibitions.

William H. Keating,	Frederick Fraley,
Samuel J. Robbins,	Joshua G. Harker,
James Ronaldson,	Alexander Ferguson,
M. W. Baldwin,	James H. Bulkley.

On Inventions.

Samuel V. Merrick,	Rufus Tyler,
Benjamin Reeves,	John Agnew,
Alexander D. Bache,	Mark Richards,
Isaiah Lukens,	Christian Gobrecht,
William H. Keating,	James J. Rush,
M. W. Baldwin,	W. R. Johnson.

On Publications.

Samuel V. Merrick,	Isaiah Lukens,
Isaac Hays, M. D.	M. W. Baldwin.
Alexander D. Bache,	

On Instruction.

Alexander D. Bache,
M. W. Baldwin,
Abraham Miller,
John Wiegand,
Charles H. White.

On the Cabinet of Models.

Rufus Tyler,
John Struthers,
John O'Neill,
Joseph H. Schreiner,
Thomas Scattergood.

On the Cabinet of Minerals.

Abraham Miller,
William H. Keating,
Isaiah Lukens,
Adam Ramage,
Thomas U. Walter.

On the Library.

Isaac Hays, M. D.
Samuel J. Robbins,
Frederick Fraley,
Thomas Scattergood,
Charles Toppan.

Managers of the Sinking Fund.

Samuel J. Robbins,
Samuel V. Merrick,
Frederick Fraley,
M. W. Baldwin.

Auditors.

Abraham Miller,
Isaac B. Garrigues.

The candidates proposed at the last meeting, were duly elected members of the Institute.

Several candidates for membership were proposed, and laid over till the next meeting, in conformity to the regulations.

Extract from the minutes.

MORDECAI D. LEWIS, *Chairman.*

W. HAMILTON, *Actuary.*

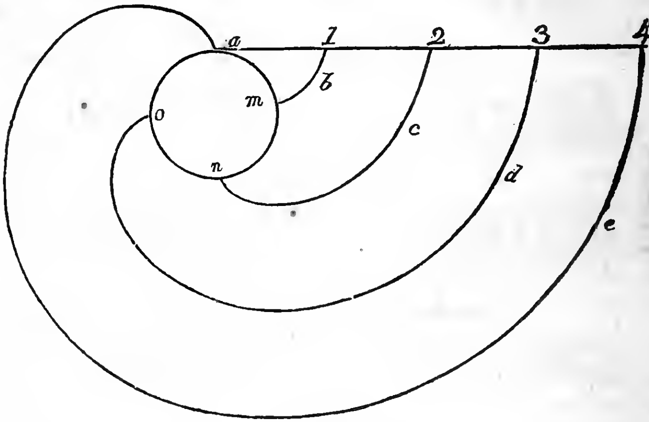
FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Remarks on the Involute.

THE curve called the involute may be formed by having a thread of any length, attached in the circumference of a circle, and stretched in a tangent to the circle, as a, 1, in the diagram, with a marking point at 1, which marking point is brought down to m, the thread being kept stretched, and winding round, and against the circle.

In a communication to this Journal, of March, 1829, on another subject, I incidentally noticed the use of this curve to express centrifugal forces. I will repeat in substance, what I then remarked, and give further examples of the practical utility of this neglected order of curves. Let the circle in the figure be the orbit of a body

revolving round an attracting centre, with a velocity that could carry it in the orbit from *a*, to *m*, in a given time; let the equal distance, *a*, to 1, on the tangential line, express that velocity. Then the curve *b*, will express the centrifugal force, or required attraction, to preserve the body in the orbit; but let the velocity be doubled, so that the body would be found in the orbit at *n*, in the same given time, then the line, *a*, 2, will express the increased projectile velocity, and the curve, *c*, the relative centrifugal force.



The line, *a*, 4, or thread, by which the curves are supposed to be made, and which represents the projectile velocity, might be indefinitely extended, so that it should be required to wind round the circle, any number of times, before the marking point should arrive in the orbit, yet the involute thus generated, would correctly express the relative centrifugal force under that velocity.

We thus see the application of this curve to express the *relative* centrifugal forces, under different projectile velocities, and before proceeding to apply it as the means of ascertaining *absolute* centrifugal forces, it is essential to state two properties of the involute, which I am not aware of having been previously known. First, that the curves generated, are to each other, as the squares of the parts of the circle, (or circumference,) on which they are generated.

Thus, if curve *b*, be equal to 1, curve *c*, will be equal to 4, curve *d*, be equal to 9, &c.

Secondly, that the involute generated on an entire circle, (as *e*,) is to that circle as the circumference of any circle is to the diameter; thus, if the circumference of the circle be 1, the curve, *e*, will be 3.1416.

Then let it be required to know the radius of a circle, in which a body revolving 60 times per minute, should have the centrifugal force equal to gravity, or, in other words, let a ball revolve on a horizontal plane, void of friction, attached to a centre by a thread, drawn by the centrifugal force in a horizontal direction. The dis-

tance from the centre of rotation to the centre of gyration in the ball, is required, which with 60 revolutions per minute, shall cause the thread to be drawn with a force equal to the weight of the ball.

We know that a constant force equal to gravity will cause the ball to describe a space, (or to fall,) equal to 16 feet 1 inch, or 193 inches in a second.

Now since the ball, by the conditions of the question, is to revolve around the entire circle in one second, and to exert a centrifugal force during that time equal to gravity, the involute generated from the entire circle, (as *e*,) which expresses the centrifugal force, must be considered equal to the force of gravity, or a space of 193 inches.

Then, as before stated, the involute generated on the entire circle, (as *e*,) is to the circumference of that circle, as the circumference of any circle is to the diameter. So will 193 inches, taken as a circumference, give a diameter of 61.4336 inches, which said 61.4336 inches is the circumference of the required circle, 19.5547 inches, being its diameter, and 9.7773 inches the radius. Let the diameter of a circle be required, on which a body revolving 30 times per minute, the centrifugal force shall equal gravity.

Then, as one revolution is performed in two seconds, and gravity will cause a body to pass through 64 feet 4 inches, or 772 inches, in that time, the involute generated on the circle, (as *e*,) must, in a similar manner to the last example, be considered as representing a centrifugal force equal to 772 inches, which taken as a circumference, gives 245.7346 inches for a diameter, which said 245.7346 inches is the circumference of the circle required, and 78.22 inches its diameter.

The length of any pendulum, which shall make a double vibration, that is, return to the point from whence it started, in a given time, is equal to the radius of a circle, on which a body revolving in the same given time, has the centrifugal force equal to gravity. And hence the involute has complete control of the pendulum.

For by the last example, a body revolving in 2 seconds in a circle of 78.22 inches diameter, has the centrifugal force equal to gravity. Therefore a pendulum equal to radius of that circle, or 39.11 inches, would make one double vibration in two seconds.

This is the length of the "seconds pendulum," or one, that makes a single vibration in one second.

And by the same rule, a pendulum equal to the radius of the circle in which the ball revolved in seconds, (say 9.7773 inches radius,) would make one double vibration in a second, or a single vibration in half a second.

The most simple way of tracing this connexion between the length of a pendulum and centrifugal force, is to suppose the pendulum to vibrate in the arc of a semicircle, which if twice performed, making a double vibration, would be equal to describing the whole circle, and the centrifugal force as shown by the involute, would be the same.

When the pendulum vibrates in smaller arcs of a circle, its times

are not materially affected, because the motion by gravity and the centrifugal force generated by the motion, both decrease in the same ratio.

Before closing this paper, I will add another example, embracing more points of investigation.

A double pendulum, or governor, such as is used to the steam engine, is revolving, as I ascertain by my watch, 40 times in a minute; the arms are centred in the vertical axis. I also observe, by a graduated arc, affixed to the stern, that the arms revolve at an angle of 34 degrees with the vertical axis. It is required to know the centrifugal force, as compared with gravity, the diameter of the circle in which the balls revolve, and the length of the arms from the point of suspension to the centre of the ball, (or of gyration.)

Solution.—The centrifugal force will be to gravity as sine to cosine of the angle of inclination, from the vertical axis, which determined in the usual way, is in this case as 2 to 3.

The balls revolve once in $1\frac{1}{2}$ seconds. Gravity is equal to a space of 434.25 inches in $1\frac{1}{2}$ seconds. Then I consider the involute generated on the circle as equal to said 434.25 inches, which taken as a circumference, gives 138.226 inches for a diameter, which is the circumference of a circle, where the centrifugal force would be equal to gravity; but the angle of the arms show the centrifugal force equal to only $\frac{2}{3}$ds of gravity, and as the centrifugal force, with the same number of revolutions, is as the size of the circle *directly*. The required circumference will be $\frac{2}{3}$ds of said 138.226 inches, or 92.15 inches. The diameter required 29.333 inches, and radius 14.667 inches.

The length of the arm will be the hypotenuse of the right angled triangle, whereof the radius, or 14.667 inches is the base, (also sine,) and 22 inches the height, (or cosine,) and is found by the ordinary method to be $26\frac{1}{2}$ inches, (very nearly.)

Then the answer will be as follows. The centrifugal force is equal to $\frac{2}{3}$ds gravity. The diameter of the circle is $29\frac{1}{3}$ inches. The length of the arm is $26\frac{1}{2}$ inches.

Those who have leisure and inclination for mathematical research, will find an interesting, and somewhat novel field of action presented by the involute, which curve deserves to be rescued from its present obscurity, and placed on a level with the favoured few, created from conic sections. THOMAS BAKEWELL.

Cincinnati, December 10th, 1830.

An inquiry into the causes of the ready Souring of American Flour, and of some other faults resulting from the mode in which it is manufactured. With suggestions on the proper means of remedying these defects.

THE following communication was received from a citizen of Philadelphia, whilst on a tour in the western states. He has had

some experience on the subject upon which he writes, and we think that he has indicated the main source of the evil in question. Perhaps better plans may be devised for effecting the end proposed, but the *principle* is undoubtedly correct. [EDITOR.

Louisville, Kentucky, October 26, 1830.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

SIR,—Although a number of years have elapsed since it was my business to be connected with the manufacturing of wheat flour, and the bread, hard or soft, made from it; still the circumstances of flour manufactured in Richmond, Va. having acquired so *respectable* a character, both at home and abroad, while that of Pennsylvania has hardly maintained its ground, and that made in this western, or rather in this interior quarter, is remarked for not keeping well, have all concurred to recall to my mind former observations, and to elicit new ideas. Of the many manufactures carried on in the United States, the making of flour is amongst the most important. It may therefore be fairly presumed that any thing having a tendency to improve this business, in however small a degree, will be acceptable to the patrons of the Journal of the Franklin Institute, which is devoted to the improvement and extension of the useful arts, and the promotion of the industry and resources of the union.

It will be found that a mixture of different wheats, that is, red, white, bearded, and common, supposing them all of good quality, and equally well manufactured into flour, will make better bread than any one of them simply. On the miller's experience and judgment depend the best proportions of this mixture, equal quantities not being that which answers best; and as it is not at all times in the miller's power, from want of the various kinds, to preserve this proportion, his skill is called upon so to proportion what he has, as to bring out the best results.

In the next place, it is a bad system to make flour entirely out of the new crop, immediately after harvest; such flour will not keep long, and it is not profitable for the baker; it will neither produce so much bread, or bread of so good a quality as a mixture of the old with the new. Suppose, for the sake of example, that for two months after the crop of any one year comes in, it is mixed with an equal portion of the crop of the preceding year, gradually diminishing the proportion of old wheat as the season advances; flour made of this composition of new and old wheat, is certain of keeping well, will make good bread, and more of it in proportion than flour used in the same quantity but made entirely of new wheat; here too the skill of the miller governs the result.

There have been, during the last twenty-five or thirty years, many improvements in the making of wheat flour, invented and introduced into this country. I believe that we are actually, if not technically, indebted to Oliver Evans, for the "Hopper Boy," the "Elevator," and many other improvements. To lessen the expense attendant on the management of the mill, by cooling of ground wheat rapidly,

has been a primary object. But when the rapidity with which wheat passes through all its processes, and is packed into the flour barrel, is too great, it is very evident that it has not sufficient time to *cool* perfectly, and to *part with its moisture;* and it is probable this is a main cause why our flour does not keep long. It is a well known fact, that from some defect in the manufacturing, a large portion of our flour soon sours, grows hard, or otherwise spoils. This is a result most injurious to the country, and one which operates very disadvantageously on the miller, the merchant, the baker, the consumer, and the general character of the article in foreign countries.

The following new mode of managing the flour is suggested to remedy the evils just spoken of; and the writer of this is confident that all the good effects proposed, will result from the practice recommended; indeed every miller will at once see the connexion between the causes assigned, and the effect produced.

When the ground wheat issues from the mill stone, it is then quite warm, from the friction of the stones; that heat causes the latent damp that exists in wheat most sensibly to develope itself. To give the meal the greatest dryness, is to communicate to it the property of keeping long, and of readily and perfectly separating from the bran; the best mode of obtaining this dryness is now our object of inquiry.

To accomplish this all important object, it is recommended to the millers to fix an active wind fan, (fan mill,) so as to blow plenty of cool and fresh air among the warm meal just as it issues from the spout of the mill stones. This stream of air would not only cool the meal, but carry off the damp that at that moment is in its greatest state of volatility, in consequence of the heat. The stream of air would go off loaded with this vapour, but still there would remain heat, and consequently expanded moisture; a stream of air from a pair of bellows might, in addition to the former plan, be carried by a hose, and blown into the elevator; and lastly, the meal, when passing from the buckets of the elevator, might be subjected to the action of a second fan.

All this would so operate on the meal, that by the time it was converted into flour, both heat and moisture would be effectually removed; and there is every reason to conclude that flour made after this manner would keep long, and the meal would also be cool and dry when it arrived at the bolting process; it would most readily be separated into flour and bran, yielding a greater quantity of flour than by the present process.

A miller to become perfectly acquainted with the mixtures of wheat that produces the best bread, should have trials made by an intelligent, careful, and good baker. To become a good miller, this is almost essential. It is well known that when wheat flour has been ground very fine, no matter how good the quality of the wheat, and how well soever the flour may appear to the eye, the baker cannot make good bread with it. The appearance of such bread is wettish and doughy, much as when the wheat has been injured by rain in harvest time. Good judges will always prefer the flour that feels

hardish, when rubbed between the finger and thumb, as if it were fine sand, and reject that which compresses and is smooth.

Very little has hitherto been written upon the making of flour, every one acting on the knowledge he has acquired from his own experience, and with him ends all the knowledge he has acquired, with the exception of what he communicates to those immediately connected with him.

Should you think what is now communicated to you in this paper likely to do good, or to induce those of more experience to digest their ideas and observations on this subject, and give them to the public, you will publish it, as then some advantage will result from this unpretending effort to benefit the community.

Although it is well known that flour frequently sours in a short time, and occasions great loss to the merchant; and the dealers in this article, find to their cost, that the western flour is specially faulty in this respect; this is not asserted of all western flour, but only of the larger portion of what passes down the Ohio. A close inquiry into the practice of the western millers, will prove that too little attention is paid to mixing wheats, and to the using of old with new wheat. The mills are small compared with the quantities of flour they produce, and consequently it is too much hurried to have time to cool. Some of the steam mills are so constructed that the whole air in the house is loaded by the steam with more vapour than the air can hold in solution; a large portion of this is thrown into the meal, so that in such places it is certain a bad keeping flour must be made.

Yours, &c.

J. R.

On Gunpowders and Detonating Matches. *By* Andrew Ure, M. D. F. R. S. &c.

Gunpowder is a mechanical combination of nitre, sulphur, and charcoal; deriving the intensity of its explosiveness from the purity of its constituents, the proportion in which they are mixed, and the intimacy of the admixture.

1. *On the Nitre.*

Nitre may be readily purified, by solution in water and crystallization, from the muddy particles and foreign salts with which it is usually contaminated. In a saturated aqueous solution of nitre, boiling hot, the temperature is 340° Fahrenheit; and the relation of the salt to its solvent is in weight as three to one, by my experiments—not five to one, as MM. Bottée and Riffault have stated.* We must not, however, adopt the general language of chemists, and say that three parts of nitre are soluble in one of boiling water, since the liquid has a much higher heat and greater solvent power than this expression implies.

* Traité de l'Art de fabriquer la Poudre á Canon, p. 78.

Water at 60° dissolves only one-fourth of its weight of nitre; or, more exactly, this saturated solution contains 21 per cent. of salt. Its specific gravity is 1.1415; 100 parts in volume of the two constituents occupy now 97.91 parts. From these data we may perceive that little advantage could be gained in refining crude nitre, by making a boiling hot *saturated* solution of it; since, on cooling, the whole would concrete into a moist saline mass, consisting by weight of $2\frac{3}{4}$ parts of salt, mixed with 1 part of water holding $\frac{1}{4}$ of salt in solution, and in bulk of $1\frac{7}{8}$ of salt, with about 1 of liquid: for the specific gravity of nitre is 2.005, or very nearly the double of water. It is better, therefore, to use equal weights of saltpetre and water in making the boiling hot solution. When the filtered liquid is allowed to cool slowly, somewhat less than three-fourths of the nitre will separate in regular crystals; while the foreign salts that were present will remain with fully one-fourth of nitre in the mother liquor. On redissolving these crystals with heat, in about two-thirds of their weight of water, a solution will result, from which crystalline nitre, fit for every purpose, will concrete on cooling.

As the principal saline impurity of saltpetre is muriate of soda, (a substance scarcely more soluble in hot than in cold water,) a ready mode thence arises of separating that salt from the nitre in mother waters that contain them in nearly equal proportion. Place an iron ladle or basin, perforated with small holes, on the bottom of the boiler in which the solution is concentrating. The muriate, as it separates by the evaporation of the water, will fall down and fill the basin, and may be removed from time to time. When small nitrous needles begin to appear, the solution must be run off into the crystallizing cooler, in which moderately pure nitre will be obtained, to be refined by another similar operation.

At the Waltham Abbey gunpowder works, the nitre is rendered so pure by successive solutions and crystallizations, that it causes no opalescence in a solution of nitrate of silver. Such crystals are dried, fused in an iron pot at a temperature of from 500° to 600° Fahrenheit, and cast into moulds. The cakes are preserved in casks.

About the period of 1794 and 1795, under the pressure of the first wars of their revolution, the French chemists employed by the government contrived an expeditious, economical, and sufficiently effective mode of purifying their nitre. It must be observed that this salt, as brought to the gunpowder works in France, is in general a much cruder article than that imported into this country from India. It is extracted from the nitrous salts contained in the mortar rubbish of old buildings, especially those of the lowest and filthiest descriptions. By their former methods the French could not refine their nitre in less time than eight or ten days; and the salt was obtained in great lumps, very difficult to dry and divide: whereas the new process was so easy and so quick, that in less than twenty-four hours, at one period of pressure, the crude saltpetre was converted into a pure salt, brought to perfect dryness, and in such a state of extreme division, as to supersede the operations of grinding and sifting, whence also considerable waste was avoided.

The following is a brief outline of this method, with certain improvements, as now practised in the establishment of the *Administration des poudres et salpêtres*, in France.

The refining boiler is charged over night with 600 kilogrammes of water, and 1200 kilogrammes of saltpetre, as delivered by the *salpêtriers*. No more fire is applied than is adequate to effect the solution of this first charge of saltpetre. It may here be observed, that such an article contains several deliquescent salts, and is much more soluble than pure nitre. On the morrow morning the fire is increased, and the boiler is charged at different intervals with fresh doses of saltpetre, till the whole amounts to 3000 kilogrammes. During these additions, care is taken to stir the liquid very diligently, and to skim off the froth as it rises. When it has been for some time in ebullition, and when it may be presumed that the solution of the nitrous salts is effected, the muriate of soda is scooped out from the bottom of the boiler, and certain affusions or inspersions of cold water are made into the pot, to quicken the precipitation of that portion which the boiling motion may have kept afloat. When no more is found to fall, one kilogramme of Flanders glue, dissolved in a sufficient quantity of hot water, is poured into the boiler; the mixture is thoroughly worked together, the froth being skimmed off, with several successive inspersions of cold water, till 400 additional kilogrammes have been introduced, constituting altogether 1000 kilogrammes.

When the refining liquor affords no more froth, and is grown perfectly clear, all manipulation must cease. The fire is withdrawn, with the exception of a mere kindling, so as to maintain the temperature till the next morning at about 88° C. = 190.4° Fahrenheit.

This liquid is now transferred by hand-basins into the crystallizing reservoirs, taking care to disturb the solution as little as possible, and to leave untouched the impure matter at the bottom. The contents of the long crystallizing cisterns are stirred backwards and forwards with wooden paddles, in order to quicken the cooling, and the consequent precipitation of the nitre in minute crystals, which is raked, as soon as it falls, to the upper ends of the doubly inclined bottom of the crystallizer. It is thence removed to the washing chests or boxes. By the incessant agitation of the liquor, no large crystals of nitre can possibly form. When the temperature has fallen to within 7° or 8° Fahrenheit of the apartment, that is, after seven or eight hours, all the saltpetre that it can yield will have been obtained. By means of the double slope given to the crystallizer, the supernatant liquid is collected in the middle of the breadth, and may be easily laded out.

The saltpetre is shovelled out of the crystallizer into the washing chests, and heaped up in them so as to stand about six or seven inches above their upper edges, in order to compensate for the subsidence which it must experience in the washing process. Each of these chests being thus filled, and their bottom holes being closed with plugs, the salt is besprinkled from the rose of a watering can with successive quantities of water saturated with saltpetre, and

also with pure water, till the liquor, when allowed to run off, indicates by the hydrometer a saturated solution. The water of each sprinkling ought to remain on the salt for two or three hours; and then it may be suffered to drain off through the plug holes below for about an hour.

All the liquor of drainage from the first watering, as well as a portion of the second, is set aside, as being considerably loaded with the foreign salts of the nitre, in order to be evaporated in the sequel with the mother waters. The last portions are preserved, because they contain almost nothing but nitre, and may, therefore serve to wash another dose of that salt. It has been proved by experience, that the quantity of water employed in washing need never exceed thirty-six sprinkles in the whole, consisting of three waterings, of which the first two consist of fifteen, and the last of six pots; or, in other words, of fifteen sprinklings of water saturated with saltpetre, and twenty-one of pure water.

The saltpetre, after remaining five or six days in the washing chests, is transported into the drying reservoirs, heated by the flue of the nearest boiler; here it is stirred up from time to time with wooden shovels, to prevent its adhering to the bottom, or running into lumps, as well as to quicken the drying process. In the course of about four hours, it gets completely dry, in which state it no longer sticks to the shovel, and falls down into a soft powder by pressure in the hand. It is perfectly white and pulverulent. It is now passed through a brass sieve, to separate any small lumps or foreign particles accidentally present, and is then packed up in bags or barrels. Even in the shortest winter days, the drying basin may be twice charged, so as to dry 700 or 800 kilogrammes. By this operation, the nett produce of 3000 kilogrammes thus refined, amounts to from 1750 to 1800 kilogrammes of very pure nitre, quite ready for the manufacture of gunpowder.

The mother waters are next concentrated; but into their management it is needless to enter in this memoir.

On reviewing the above process as practised at present, it is obvious that, to meet the revolutionary crisis, its conductors must have shortened it greatly, and have been content with a brief period of drainage.

2. *On the Sulphur.*

The sulphur now imported into this country, from the volcanic districts of Sicily and Italy, for our manufactories of sulphuric acid, is much purer than the sulphur obtained by artificial heat from any variety of pyrites, and may, therefore, by simple processes, be rendered a fit constituent of the best gunpowder. As it is not my purpose here to repeat what may be found in common chemical compilations, I shall say nothing of the sublimation of sulphur; a process, moreover, much too wasteful for the gunpowder maker.

Sulphur may be most easily analyzed, even by the manufacturer himself; for I find it to be soluble in one-tenth of its weight of boiling oil of turpentine, at 316° Fahrenheit, forming a solution which

remains clear at 180°. As it cools to the atmospheric temperature, beautiful crystalline needles form, which may be washed sufficiently with cold alcohol, or even tepid water. The usual impurities of the sulphur, which are carbonate and sulphate of zinc, oxide and sulphuret of iron, sulphuret of arsenic and silica, will remain unaffected by the volatile oil; and may be separately eliminated by the curious, though such separation is of little practical importance.

Two modes of refining sulphur for the gunpowder works have been employed; the first is by fusion, the second by distillation. Since this combustible solid becomes as limpid as water at the temperature of about 230° Fahrenheit, a ready mode offers of removing at once its denser and lighter impurities, by subsidence and skimming. But I may take the liberty of observing that the French melting pot, as described in the elaborate work of MM. Bottée and Riffault, is singularly awkward, for the fire is kindled right under it, and plays on its bottom. Now a pot for subsidence ought to be *cold-set;* that is, should have its bottom part imbedded in clay or mortar for four or six inches up the side, and be exposed to the circulating flame of the fire only round its middle zone. This arrangement is adopted in many of our great chemical works, and is found to be very advantageous. With such a boiler, judiciously heated, I believe that crude sulphur might be made remarkably pure; whereas, by directing the heat against the bottom of the vessel, the crudities are tossed up and incorporated with the mass.

The sulphur of commerce occurs in three prevailing colours; lemon yellow verging on green, dark yellow, and brown yellow. As these different shades result from the different degrees of heat to which it has been exposed in its original extraction on the great scale, we may thereby judge to what point it may still be heated anew in the refinery melting. Whatever be the actual shade of the crude article, the art of the refiner consists in regulating the heat, so that after the operation it may possess a brilliant yellow hue, inclining somewhat to green.

In seeking to accomplish this purpose, the sulphur should first be sorted according to its shades; and if a greenish variety is to be purified, since this kind has been but little heated in its extraction, the fusion may be urged pretty smartly, or the fire may be kept up till every thing is melted but the uppermost layer.

Sulphur of a strong yellow tinge cannot bear so great a heat, and therefore the fire must be withdrawn whenever three-fourths of the whole mass have been melted.

Brown coloured brimstone, having been already somewhat scorched, should be heated as little as possible, and the fire may be removed as soon as one-half of the mass is fused.

Instead of melting, separately, sulphurs of different shades, we would obtain a better result, by first filling up the pot to half its capacity, with the greenish coloured, putting over this layer, one quarter volume of the deep yellow, and filling it to the brim with the brown coloured. The fire must be extinguished as soon as the yellow is fused. The pot must then be closely covered for some

time; after which the lighter impurities will be found on the surface in a black froth, which is skimmed off, and the heavier ones sink to the bottom. The sulphur itself must be left in the pot for ten or twelve hours, after which it is laded out into the crystallizing boxes or casks.

Distillation affords a more complete and very economical means of purifying sulphur, which was first introduced into the French gunpowder establishments, when their importation of the best Italian and Sicilian sulphur was obstructed by the British navy. Here the sulphur need not come over slowly in a rare vapour, and be deposited in a pulverulent form called flowers; for the only object of the refiner is to bring over the whole of the pure sulphur into his condensing chamber, and to leave all its crudities in the body of the still. Hence a strong fire is applied to elevate a denser mass of vapours, of a yellowish colour, which passing over into the condenser, are deposited in a liquid state on its bottom, whilst only a few lighter particles attach themselves to the upper and lateral surfaces. The refiner must, therefore, give to the heat in this operation, very considerable intensity; and at some height above the edge of the boiler, he should provide an inclined plane, which may let the first ebullition of the sulphur overflow in a safety recipient. The condensing chamber should be hot enough to maintain the distilled sulphur in a fluid state,—an object most readily procured by leading the pipes of several distilling pots into it; while the continuity of the operations is secured, by charging each of the stills alternately, or in succession. The heat of the recipient must be never so high as to bring the sulphur to a siropy consistence, whereby its colour is darkened.

In the *sublimation* of sulphur, a pot containing about four cwt., can be worked off only once in twenty-four hours, from the requisite moderation of its temperature, and the precaution of an inclined plane, which restores to it the accidental ebullitions. But by *distillation*, a pot containing full ten cwt. may complete one process in nine hours at most, with a very considerable saving of fuel. In the former plan of procedure, an interval must elapse between the successive charges; but in the latter, the operation must be continuous to prevent the apparatus from being cooled: in sublimation, moreover, where communication of atmospheric air to the condensing chamber is indispensable, explosive combustions of the sulphurous vapours frequently occur, with a copious production of sulphurous acid, and correspondent waste of the sulphur; disadvantages from which the distillatory process is in a great measure exempt.

I shall here give an outline of the form and dimensions of the distilling apparatus employed at Marseilles in purifying sulphur for the national gunpowder works, which was found adequate to supply the wants of Napoleon's great empire. This apparatus consists of only two still pots of cast iron, formed like the large end of an egg, each about three feet in diameter, two feet deep, and nearly half an inch thick at the bottom, but much thinner above, with a horizontal ledge four inches broad. A pot of good cast iron is capable of distilling 1000 pounds of sulphur before it is rendered unservice-

able, by the action of the brimstone on its substance, aided by a strong red heat. The pot is covered in with a sloping roof of masonry, the upper end of which abuts on the masonry of the vaulted dome of condensation. A large door is formed in the masonry, in front of the mouth of the pot, through which it is charged and cleared out; and between the roof space over the pot, and the cavity of the vault, a large passage is opened. At the back of the pot a stone step is raised to prevent the sulphur boiling over into the condenser. The vault is about ten feet wide within, and fourteen feet from the bottom up to the middle of the dome, which is perforated, and carries a chimney about twelve feet high, and twelve inches diameter within.

As the dome is exposed to the expansive force of a strong heat, and to a very considerable pressure of gases and vapours, it must possess great solidity, and is therefore bound with iron straps. Between the still and the contiguous wall of the condensing chamber, a space must be left for the circulation of air, a precaution found indispensable by experience; for the contact of the furnaces produces on the wall of the chamber such a heat as to make it crack and form crevices for the liquid sulphur to escape. The sides of the chamber are constructed of solid masonry, forty inches thick, surmounted by a brick dome, covered with a layer of stones. The floor is paved with tiles, and the walls are lined with them up to the springing of the dome; a square hole being left in one side, furnished with a strong iron door, at which the liquid sulphur is drawn off at proper intervals. In the roof of the vault are two valve holes, covered with light plates of sheet iron, which turn freely on hinges at one end, so as to give way readily to any sudden expansion from within, and thus prevent dangerous explosions.

As the chamber is an oblong square, terminating upwards in an oblong vault, it consists of a parallelopiped below, and a semi-cylinder above, having the following dimensions:—

Length of the parallelopiped, - -	$16\frac{1}{2}$ feet.
Width, - - - - - - - -	$10\frac{4}{5}$
Height, - - - - - - - -	$7\frac{1}{4}$
Radius of the cylinder, - - - - -	$5\frac{2}{5}$
Height or length of semi-cylinder, -	$16\frac{1}{2}$

Whenever the workman has introduced into each pot its charge of ten or twelve hundred weight of crude sulphur, he closes the charging doors carefully with their iron plates and cross bars, and lutes them tight with loam. He then kindles his fires, and makes the sulphur boil. One of his first duties, (and the least neglect in its discharge, may occasion serious accidents,) is to inspect the roof-valves, and to clean them, so that they may play freely before any expulsive force from within. By means of a cord and chain, connected with a crank attached to the valves, he can, from time to time, ascertain their state, without mounting on the roof. It is found proper to work one of the pots a certain time before fire is applied to the other. The more steadily vapours of sulphur are seen to issue from the valves, the less atmospherical air can exist in the chamber,

and therefore the less danger there is of combustion. But if the air be cold, with a sharp north wind, and if no vapours be escaping, the operator should stand on his guard, for in such circumstances a serious explosion may ensue.

As soon as both the boilers are in full work, the air is expelled, the fumes cease, and every hazard is at an end. He should bend his whole attention to cut off all communication with the atmosphere, securing simply the mobility of the valves, and a steady vigour of distillation. The conclusion of the process is ascertained by introducing his sounding rod into the pot, through a small orifice made for its passage in the wall. A new charge must now be given.

By the above process, well conducted, sulphurs are brought to the most perfect state of purity that the arts can require; while not above four parts in a hundred of the sulphur itself are consumed; the crude, incombustible residuum varying from five to eight parts, according to the nature of the raw material. But in subliming sulphur, the frequent combustions inseparable from this operation carry the loss of weight in flowers to about twenty per cent.

The process by fusion, performed at some of the public works in this country, does not afford a return at all comparable with that of the above French process, though a much better article is operated upon in England. After two meltings of *grough* sulphur, (as imported from Sicily or Italy,) eighty-four per cent. is the maximum amount obtained, the average being probably under eighty; while the product is certainly inferior in quality to that by distillation.

[*Journal of the Royal Institution.*

[TO BE CONTINUED.]

Account of the processes followed in Mexico, in the reduction of the Precious Metals. Extracted from a review of a work entitled "Commentaries on the Mining Ordinances of Spain;" contained in the Journal of the Royal Institution of Great Britain.

One object of the author of the above work, is to give as much instruction and useful information as he could collect, on the various subjects connected with mining and the reduction of the metallic ores; and particularly that which is of a nature to interest the practical miner and metallurgist, and to lead them to the attainment of greater perfection in their several departments.

Amongst the most interesting of the subjects discussed under this head, is that of the reduction of the ores of the precious metals; under which the author takes an opportunity to describe the processes employed for that purpose in Mexico, at the period when he wrote, and which are, with little or no variation, the same now practised in that country. The Mexicans are not so rude and unskilled in the art of reducing their ores, as they have been erroneously supposed in this country to be. The processes employed by them, although conducted with little scientific knowledge, and, generally speaking, with no other guide than long practice and experience in the pur-

suit, are found, from the nature of the ores, and the circumstances of climate and other local accidents, to be better adapted for that country than any others, as is sufficiently proved by the complete failure of Sonneschnied and his colleagues, in their attempt, under the auspices of Charles III., to introduce into America the improvements of Europe.*

The smelting process is described by the author as follows:—

"*Of preparing and mixing the ores, previous to their reduction by smelting. Of the construction of the various smelting furnaces employed.*—All the ore raised from the mines is carried to the reduction works, where a receipt is signed on the memorandum brought by the carrier from the mine. The workmen at the reduction works, taught by experience, distinguish the ores adapted for smelting, from those proper for amalgamation, according to their nature, and arrange them separately in an office or store room. The ore is pounded by beating with a pick or hammer, or more readily, and at less expense, in stamping mills; and being reduced to fragments of a greater or less size, according to its tractability or obstinacy under the action of the fire, it is piled in heaps, or spread out at once for the purpose of making the *revoltura* or *revolturon*, which is the mixing together of several ingredients, namely, the principal ore, the assistant ore,† litharge, impregnated cupels or bottoms of furnaces, *plomillos*,‡ *fierros*,§ and slag.

"In making this mixture, the nature of the ore is attended to; some ores requiring a mixture of all these ingredients, and others not. No general rule, however, can be given for these mixtures, but the miner must frame rules for his own government, founded on repeated experiments and long observation, making him familiar with the nature of the ore.

"The mixture, being prepared in the manner above described, is placed in the furnace to be smelted. There are many descriptions of furnaces; some being made of stone, some of mud bricks, and some of clay. In some the smelting is performed with wood, in others with charcoal; in some the mouths or apertures are stopped up, and in others left open. In some, the ore and wood are mingled together; in others, the wood or charcoal is not in contact with the ore, but the flame only, whence they are called *reverberatory* furnaces.

"*Of the smelting of ores.*—Having made the proper mixture, and prepared the furnaces and the machines for supplying them with wind, the smelter must heat or anneal the furnace, if, from being

* See Sonneschnied's *Tratado de la Amalgamacion de Nueva Espana;* in the preface to which the author acknowledges his inability, after ten years labour, to introduce with effect, into Mexico, either the process of Baron Born, or any other, preferable to that of the *patio*, which, he says, in p. 91, of the work, "has subsisted two centuries and a half, and will subsist as long as the world endures."

† "Metal de Ayuda"—Ore of a more fusible character, mixed with the less tractable ores to assist their fusion.

‡ "Plomillos"—Scoriæ charged with *lead*.

§ "Fierros"—Slag or scum, being an unreduced mass of oxides and sulphurets, in which those of *iron* predominate.

new or newly repaired, it requires it; for, if the ore be thrown in whilst the furnace is cold, it is apt, upon getting warm, to fly or crack, with danger to the bystanders: and if it be moist, in the summer, the same thing will happen, and it will explode with very great force. During the first few hours, charcoal is first thrown in, then a basket of slags, then one of charcoal, and so on, until it be time to add the mixed ore. Half a basketful of this is then thrown in, and upon that a basket of charcoal, and so on, until the furnace begins to work, after which, alternate basketsful of mixed ore and charcoal are thrown in. One or two *cargas* of charcoal are consumed for each charge, according to the nature of the ore; some ores requiring the furnace to be moderately filled; others, that it should be filled to the top. If the ore be not earthy, but clean, the furnace may be charged freely.

"The furnace being thus arranged and brought into play, smelts four charges in twenty-four hours, the ingots being tapped off from time to time; for which purpose, an aperture is made below the bridge of the breast pan, and the melted portions run off into the float. The first ingot let off, after repairing the furnace, is called *calentadura*, and is smaller than the others, because the furnace becomes coated with vitrified ore adhering to it, and care is therefore taken not to throw in rich ores for the *calentadura.* The fused metal being let off, the bridge is stopped up, the breast pan is cleared out, charcoal dust is thrown into and around it, and the furnace is again set to work. The portions which may have adhered to it are taken off last of all, and are mixed with the ores in future smeltings.

"After the smelting is performed, the furnace is uncharged, which is done in the following manner. The charges of ore being all finished, slags and charcoal alone are thrown in, until all the smelted ore has flowed into the breast pan, when the furnace throws off a very beautiful flame. The wall of mud bricks, and every thing which may have adhered to it, are then broken down with a crow or iron bar of about twenty-five pounds weight. And here the unfortunate smelters suffer much, during an hour of great labour; for the furnace is hot in the extreme, the crow is heavy, and the incrusted matter adheres very closely. The smoke and vapour from the slag, which are quenched by pouring water upon them, and which are consequently carried down to the feet of the workmen, are poisonous; and as they drink water incessantly to relieve their exhaustion, they lose the use of their hands and feet, and become bloated. They are subject also to violent pains in the stomach, occasioned by the coldness of the ore."

After describing the mode of refining the silver, the author proceeds to describe the operation of cold amalgamation, or amalgamation by the *patio*, by which the greater part of the gold and silver now circulating over the whole globe has been reduced from the ore.

"*Of the reduction of ores by quicksilver.*—Nature, by exhibiting to mankind the effect of fire in fusing the surface of mountains, first suggested to them the idea of smelting the ores containing lead. Nature also, by setting before them the particles of quicksilver found

amongst the ores, first guided them to the method of mixing the harsh ores with quicksilver, salt, and water; an operation which, although in the infancy of the discovery rude and troublesome in practice, requiring many months to effect the reduction of the gold and silver, has now, by the devices of art, and the lessons of experience, (the best instructer in the hidden mysteries of physics,) been carried to perfection; *magistral** and various other mixtures being employed, so that the ore may be reduced in twenty days, or under—and the process has even been completed in twenty-four hours.

"The object of first importance, in the process of amalgamation, is to provide a skilful amalgamator, capable of distinguishing between smelting ores, and those adapted for amalgamation; who can make assays, in the small way, to ascertain what the *monton* will yield in gross; who understands the proper ingredients, temperatures, admixtures, and stirrings to be applied, and who can calculate and compare the probable amount of the expenses and of the metallic produce: for the bringing the silver to the proper point is not to be entrusted to a mere ignorant blockhead.

"Secondly, a due selection of the ores must be made for the purpose, in performing the reduction by amalgamation, of making such mixtures as their nature may require; and such ores as require smelting, must be set apart for that operation.

"Third, the ore must be ground as fine as possible, that the quicksilver may combine more readily with the silver.

"Fourth, the ore being ground, it is the practice, in some districts, to roast such as is of a sulphurous or bituminous (?) nature, in furnaces adapted for that purpose; in which the criterion of being sufficiently purified, is the ceasing to give off vapour. The same treatment is also applied to the pyritous or resplendent ores, which, under the influence of fire, lose their splendour, and at the same time, get rid of their prejudicial qualities. Those which contain litharge or copperas, should not be roasted, until they have been washed and thoroughly agitated in tubs of water, so as to separate the copperas; for unless this precaution be taken, it will be increased in quantity by the action of the fire, instead of being driven off, and it will have the effect of destroying the quicksilver, and preventing its uniting with the silver. It is sometimes proper to roast the ore after grinding, and sometimes while in the rough. But the most usual course, in the mining districts of New Spain, is not to roast the ore at all, on account of the injurious effect of the operation, in rendering it dry, in diminishing its richness, and in augmenting its bad qualities.

"Fifth, the ore being ground, is thrown into heaps or *montons*, usually of 30 quintals; but in some places of 18 quintals: and the *montons* are sometimes placed beneath a roof, but most frequently in a well flagged yard or *patio*, whence this mode of reduction is called the reduction by the *patio*.

"Sixth, with each *monton* of 18 quintals, are mixed two barrels

* Sulphuret of copper, roasted and ground to powder.—*Trans.*

of brine, from impure salt; six, eight, or ten pounds of *magistral*, as the nature of the ore may require, and from ten to twelve pounds of quicksilver. The *monton* thus prepared, is stirred and trodden, which is called *repasar.* After two or three days, the stirring and treading are repeated, and if it require more quicksilver, a further charge is thrown in, and it is again stirred, until found to require no more: and it is to be observed, that the more quicksilver it requires, the better, as a proportionate quantity of silver may be expected.

"Seventh, the quicksilver must be added at different times, and not be thrown in all at once, so that it may by degrees take up the whole of the silver. The first stirrings must be performed with softness and gentleness, lest the quicksilver should become too minutely divided, and form *lis*, which is the term applied when it divides into almost imperceptible particles. From the varying nature of the ore, and the diversity of circumstances which arise, no certain rules can be laid down for the course to be pursued in stirring in the quicksilver and *magistral*, and it will therefore be found, that it is sometimes necessary to excite heat by stirring, and at others to apply moisture. Neither is it possible to determine the precise moment at which the *montons* are in a state for washing, for though they may not make any *lis* of silver, nor require any more quicksilver, yet the quicksilver may be dispersed. The only rule is, to ascertain whether the proportion of silver taken up, corresponds with the result of the assay made at the commencement of the process; and there is no way of ascertaining this, but by making a further trial, in a small way, whether the *monton* is in want of any addition, which in such case must be supplied, or whether it is complete, in which latter case the *monton* may be washed.

"Eighth, the *monton* being ready for washing, is thrown into wooden vats of very large size, within each of which is contained a mill. The mill is turned by a mule, and it is proper that it should not always go round in the same direction, but that the motion should be sometimes reversed: the object being, that the *lises* of silver may fall to the bottom, and that the quicksilver contained therein may not be lost by escaping with the slime or earthy residue, which contains a proportion of silver, and also of quicksilver in a minute state of division. To prevent this loss, it is therefore necessary that the mixture should be kept briskly stirred in every part. The slime being separated, the quicksilver remains at the bottom of the vat, combined with the silver, in which state it is called amalgam. The amalgam is taken out and placed in a linen bag, which being suspended from the beams, the uncombined quicksilver runs out. The part which remains in close combination is made up into small cakes, which are formed into one large cake or *piña*, (pine apple,) the size being adapted to the capacity of the brass cap or bell. The latter consists of two pieces, the first of which is in the form of a large basin, with a groove round the rim and a hole in the bottom. On the inner part of the rim are three rests, on which is placed a grating, made of iron bars, and upon that is set the *piña* or cake, which

is covered over with the cap. The cap is bell shaped, and fits into the groove of the vessel, which must be surrounded with earth, and have a pan of water beneath it. The cap or bell remains above, and is covered entirely with ignited charcoal, the heat from which, raising the quicksilver in vapour, it finds its way into the vessel, and passing through the hole in the bottom, is received in the pan of water, and brought back into the state of fluid quicksilver. Where caps of brass, copper, or iron, cannot be procured, they must be made of the finest clay, adapted to resist the fire.

"The proportion of silver returned, depends on the quality of the ore; sometimes the produce of silver is equal to an eighth part of the quicksilver mixed in with the *monton*, sometimes a sixth part, and sometimes a fifth part. The quicksilver separated in a liquid state, still contains minute particles of silver, and it is set apart to be used in working other *montons*, until consumed. This is the only part really consumed;* for the rest is either lost by being converted into *lis* in the *montons*, or escapes with the slime, from the agitation of the mill, being divided into the most minute and imperceptible particles. A quintal of quicksilver is not wholly consumed until after it has been employed seventeen times."

When the ore is tolerably rich, and a more speedy return of the silver is desired, another process is sometimes resorted to, which is called the *beneficio par cazo*, or reduction by the *cazo*. This process has the advantage of wasting very little quicksilver, and is thus described:—

"*Reduction by the cazo*, (*pan*.)—This method of reduction affords the most speedy means of extracting the silver. The ore being thoroughly ground, and a quintal being taken, the proper quantities of salt, water, and quicksilver, are mixed in, according to the nature of the ore. The mixture is then placed over the fire, and must be kept constantly stirred, and the act of ebullition further assists in keeping it in motion. It is tried from time to time, to ascertain whether it requires any further addition of quicksilver or salt. Each pan will reduce three charges per day. If the ore be rich it will often yield a marc, a marc and a half, or two marcs per quintal: and provided the quality be not lower than six ounces, this mode of reduction is very advantageous; but if the produce of silver be below that rate, it will not answer, from the great consumption of wood, quicksilver, and salt, together with the cost of the pans and coppers. The latter must be closely attended to, to see that there are no chinks or cracks in the bottom, through which the quicksilver might escape; to prevent which, they should be varnished with several coats of lime, slag, iron, and white of egg, well beaten up together. *Barba* expresses himself in highly approbatory terms of this method of reduction, both on account of the saving in quicksilver,

* In Mexico, the difference between the quantity of quicksilver employed in the process of reduction and the quantity recovered, is arbitrarily divided into quicksilver *consumed* and quicksilver *lost;* a quantity equal or proportionate in weight to the silver obtained, being said to be *consumed,* and the remainder of the deficient quicksilver to be *lost.*—*Trans.*

and because fuel may be supplied from various trailing plants, which abound in the Indies, and may likewise be much economised by making one furnace heat four pans, as we have seen in several sugar mills in the kingdom of Mexico.

"The assays in the small way will indicate, exactly, what quantity of silver the boiling should yield; but this is more readily ascertained by inspecting the substance itself, which, being taken out with a ladle, and the slime being separated, the metal remains. The slime is separated by washing, in vats of water, supplied from a cistern appropriated to the purpose. This operation removes all the earthy matter and slime; which, when a sufficiency is collected, are worked over in the process of reduction by cold amalgamation. The quicksilver settles, and is found at the bottom of the vat, combined with the silver. The quicksilver is then separated, in the manner described under the head of reduction, by the *patio;* but it always requires refining, never turning out pure, like that from the *patio.*"

A third method depends on the employment of sulphate of copper, or *colpa.* This process, called the *beneficio por colpa,* is as follows:—

"*Of the reduction by colpa,* (*sulphate of copper.*)—The plan or sketch of the new method of reducing the silver from all classes of ore, whether cold or warm, by means of *colpa,* or white or yellow copperas, was described by Don Lorenzo Phelipe de la Torre Barrio y Lima, a proprietor of mines in the district of San Juan de Lucanas, in Peru, and was printed at Lima, in 1738, and reprinted at Madrid, in 1743; where a summary of the discovery was likewise printed separately, in the same year, which met with commendation from the pen of Father Feyjoo.* The discovery consists in employing *colpa,* or copperas; the goodness of which is tried by reducing it to powder, moistening it with water, and throwing some globules of quicksilver into it. If the quicksilver spreads, or separates into minute particles, the *colpa* is good; and the like if the quicksilver, when placed on the *colpa,* and stirred in a cup or with the finger, assumes a bluish ash colour, or divides.

"The ore and the *colpa* being well ground, the latter is to be taken in an equal proportion to the salt used. The mixture is to be stirred, as in the ordinary process of reduction, four times a day, and is afterwards to be charged with about two quintals more of the *colpa,* and water is to be sprinkled uniformly over it. The quicksilver is then to be stirred in, in such quantity as the nature of the ore may require. After six days an assay is made, the stirring being continued; and if the ore be too warm, it is allowed to cool, or lime is thrown in; after which fresh charges of quicksilver are added from time to time. The slime must be washed without throwing in any quicksilver by way of *baño.*† When the quicksilver is driven off, it will be found that a greater proportion of silver is obtained, and that none of the quicksilver is consumed, except such part as is lost

* Cartas eruditas, tom. ii. carta 19.

† A term applied to a supplementary proportion of quicksilver, usually thrown in by way of softening the slime preparatory to washing.—*Trans.*

in the stirring, or from other accidental circumstances. This is the method pursued with the cold ores.

"For the warm ores it is said, that when ground, a basketful of lime is to be thrown uniformly over them. To twenty-five quintals of ore, ten *arrobas** of salt are to be added, with a sufficient quantity of water, and the mixture must undergo four stirrings. The next day, the *colpa*, being first well prepared, is to be added, in the proportion of one-half, to the weight of salt used; and a sufficient quantity of water being added, the mass is to be stirred four times, and as often on the following day. The mass being spread abroad, another *arroba* of *colpa* is to be thrown in, distributing it uniformly, and the mixture is to be sprinkled with water. When thus moistened, the quicksilver is to be stirred in; and three days after, it must be ascertained, as in the ordinary mode of reduction, whether the *montons* are cold and require more stirring, or whether they are warm, and demand a further addition of lime."

Other methods of reduction are likewise described, which, being in less general use, we pass over.

When on the subject of boundaries, the author describes, at some length, the method of mine surveying practised in New Spain, and the simple instruments employed for that purpose; and he takes occasion to recommend the adoption of the method then practised in Europe, which he illustrates by descriptions of the instruments, figures, and diagrams. (Vol. i. p. 327, &c.) The latter method being, in principle, though not in all its details, the same which is now pursued in the Cornish mines, it is unnecessary to refer to it more particularly.

The various machinery employed in mining and the reduction of the ores, is also described and illustrated by faithful, though rude figures. (Vol. ii. p. 189, &c.)

In another part of his work, the author discusses the expediency of opening the quicksilver mines of New Spain, and the probability of their admitting of being worked with advantage. The trade in quicksilver being monopolized by the crown of Spain, no mines of that metal were allowed to be worked, but those of *El Almaden*, in Old Spain, and Guancavelica in Peru, and hence no progress was ever made in turning to advantage the quicksilver veins of New Spain. But that there are such veins, and that they might be worked to much advantage, is evident from the following passages:—

"In stating above, that we have not met with any account of mines of quicksilver having been worked in the early times after the discovery of the kingdom of New Spain, we are to be understood as referring to the sixteenth century, the era of the conquest; but subsequent to that period, many instances may be found.

"First, some quicksilver mines were discovered in the jurisdiction of Chilapa, at sixty leagues distance from Mexico, to the southward.† Don Gonzalo Suarez de San Martin went over in August, 1676, to

* An *arroba* is 25 lbs. Spanish.—*Trans.*

† Villa Senor, Theatro, Americano, tom. i. page 178.

explore these mines, with a master smith and master bricklayer, and having set up a shed, a house, a smithy and furnaces, he had a part of the crest of the vein blasted away on the 14th of October, and commenced the works of San Mateo, San Joseph, and Santa Catalina, all contiguous. He began three adits at a greater depth; but the hardness of the ground obliged him to remove half a league farther down, where, finding fair indications of success, he drove the work of la Concepcion. Here also he found very good ore, in a matrix of white spar, and drove a work, which he called los Reyes. He then drove an adit in a cross direction, and, at the distance of 47 *varas*, cut a vein of considerable size. Several assays were made of the ores from these works, both in the large and small way. Those from San Mateo yielded, by the minute assay, 12 ounces of quicksilver per quintal, those from Concepcion 25 ounces, those from the cross cut 26 ounces.

"The second instance was during the viceroyalty of the Duke de la Conquista, who, in the year 1740, commissioned Don Philip Cayetano de Medina, an alderman of Mexico, and proprietor of the estate in which the Cerros of el Carro and el Picacho were situated, and Don Gregorio de Olloqui, an inhabitant of San Luis Potosi, to inspect some quicksilver mines in the aforesaid Cerros, which, according to Don Mathias de la Mota,* are in the jurisdiction of the Sierra de Pinos, in the kingdom of New Galicia. The result of this commission has not become known.

"The third instance is that stated above, as having occurred in respect to these very mines of el Carro and el Picacho, in the year 1745, when the working of a newly discovered mine of quicksilver was taken up by Don Fermin de Echevers, the president of Guadalaxara. On this occasion, we know from very good authority, that the vein was found to be rich, abundant, and easily worked, and equal to the supply of the whole kingdom of New Spain; and also, that upon the result of the reduction of some of the ore, conducted under the president's orders, the cost of the quicksilver amounted to no more than 22 or 23 dollars per quintal.

"The fourth instance we shall mention, occurred previously to the last, being in the year 1743, early in the viceroyalty of Count Fuenclara, by whose order doctor Pedro Malo da Villavicencio, senior judge of the royal audiency, set out for the purpose of exploring some other quicksilver mines near Temascaltepec, the ores of which had been subjected to several experiments and assays at Mexico, by Don Manuel de Villegas Puente, factor of the royal stores, who now accompanied the senior judge; but their investigations failed of any beneficial result, and it appears that nothing but urgent necessity will ever induce the government to sanction the laws permitting mines of quicksilver to be worked, like those of silver, gold, or any other metal.

"Yet, as it is evident that there are within this kingdom mines of quicksilver, which the crown might at any moment order to be

* Mota, MS. History of New Galicia, c. 62, n. fin.

worked, nothing is easier than to demonstrate the expediency of adopting the same plan here, which has succeeded so well in the famous mines of Guancavelica in Peru.* For, first, whenever the supply of quicksilver fails, as has happened times without number, either in consequence of war, of losses at sea, or of the delay attendant upon procuring it from such a distance, the reduction of the ore in the amalgamation works is brought to a stand, the revenue is thrown into arrear, the whole kingdom suffers, the working of the mines is interfered with, and trade receives a check. By setting the quicksilver mines at work, all, or most of these evils, would be remedied, facilities would be afforded for reducing the silver in an expeditious manner, and the amount of the tenths, the one per cent. and the coinage duty would be augmented."

In confirmation of the above, it may be added, that other veins of quicksilver, appearing, by the analysis of Professor Del Rio, to afford ores worth working, have recently been discovered in Mexico. Analyses of two specimens of the ore may be seen in the Philosophical Magazine for August, 1828.

Mr. Ogden's *Marine Steam Engine.*

Sir,—In an account given in a late Liverpool paper of a public dinner of engineers and others, friends to the promotion of steam power, on the 15th of September last, I observe that the health of Mr. Ogden, the consul of the United States, at Liverpool, was proposed by Mr. Vignoles, C. E. and drank with great applause, as the person who was "the first to apply the power of steam to navigation on the ocean." Not being at all aware of Mr. Ogden's claims in this respect, and perceiving that the Editor of the "Mechanics' Magazine" was one of the party who joined in this public acknowledgment of them, I take the liberty of applying to him for some information on the subject. I doubt not that there are many others equally ignorant with myself of the service which Mr. Ogden appears to have rendered to navigation, and to whom a detail of the particulars attending it will be as acceptable as to,

Sir, your obedient servant,

W. H.

Warrington, October 15, 1830.

The grounds on which Mr. Ogden is considered entitled to the honour of being the first to apply steam to navigation *on the ocean*, admit of a very satisfactory explanation. In 1810, Mr. Ogden was engaged in making some experiments with a small steam boat, and then, as we have been informed, first gave his serious attention to the subject of steam navigation. On the following year, he made a plan, and gave a drawing of an engine, to a friend, which he proposed he should adopt for a boat he was about building. Mr. Og-

* Solorz. Polit. lib. 6, cap. 2.

den's attention being diverted from this object by other business, he thought no more of it until 1813, when having again leisure, he matured the plan before alluded to, and obtained a patent for it from the government of the United States. The specification was in the following terms:—"This improvement is predicated on the fact demonstrated by Mr. Watt, that the elasticity of steam being proportionate to its density, its expansion, on being stopped off at one-fourth, one-third, or one-half, the capacity of the cylinder, will produce a power in a much greater ratio than one-fourth, one-third, or one-half of the whole, (vide Encyclopædia, American edition, art. Steam, Plate 478, Fig. 10.) I propose working steam, of whatever density, in two cylinders or other vessels, to be stopped off at any point from one-eighth to one-half. If at one-half, the instant one cylinder is half filled, its steam valve is closed, and that of the other is opened; on its piston arriving at the end of the stroke, that of the other will have performed half a one; *its* steam valve will then be closed; and that of the first again opened, as well as its opposite condensing valve; thus the motion will be regularly continued, each cylinder alternately half filled with steam," &c. &c. Mr. O. further claims as his invention, the application of the powers of the two pistons, in such a manner that they shall act simultaneously on the same axis at right angles with each other. It is plain that when one is at its minimum, the other being at its maximum, will carry it past the point, and that they will mutually tend to equalise the motion, thereby doing away the necessity of balance wheels."

In 1814, B. H. Latrobe, Esq. an engineer and architect of some celebrity in the United States, constructed the first engine on this principle; not, however, until he had combatted that principle most stoutly; insisting that, from the inequality of their motions, two cranks could never be brought to act together. Mr. Latrobe was induced, however, to try the experiment, and the result was most satisfactory.

In 1815-16, Mr. Ogden built a boat in the neighbourhood of New York, and set up on board of her an engine of two 27 inch cylinders, with a four foot stroke, shutting off the steam at one-half. With this boat he proceeded, in May, 1816, from New York to Virginia, where she was established to run between Norfolk and Richmond. During the passage they encountered a severe gale, when her performance astonished every person, and proved, most satisfactorily to Mr. Ogden's mind, the advantages of steam in any situation. In the autumn of that year, Mr. O. came to this country, and had an engine constructed by Fenton, Murray, and Wood, of Leeds. The same builders afterwards furnished another, from the same patterns, of two 33 inch cylinders, which Mr. O. put on board of a steam tug for the river Mississippi, and which we have heard him say he has frequently seen ascending that stream against a current of three miles and a half with a ship of three or four hundred tons on each side, and two smaller vessels, brigs or schooners, astern.

[*Editor Mechanics' Magazine.*

Description of the various kinds of Paper.

We have been requested to insert the following description of the various kinds of paper, which appeared in the *London Mechanics' Magazine*, for February, 1829. The article, which is understood to be very accurately drawn up, is rarely to be met with at the present time.

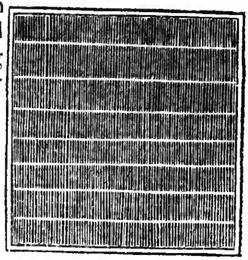
The water marks used by the English manufacturers are figured in the original paper, but are here omitted, as having little interest for the American manufacturer, or dealer. Ed.

It was well remarked by the great philosopher, Boyle, that "if every artist would but communicate what new observations occurred to him in the exercise of his trade, the advantages gained to philosophy would be incalculable."

Under a conviction of the extensive application of the above truth, I submit the following information (first collected, with some pains, for my own use,) for insertion in your widely circulated miscellany; and although the title of *new* will not apply to it, yet, as I am not aware of any thing of the kind having before appeared in print, I hope it will be considered sufficiently scientific, and of such general interest, as to procure for it that honour.

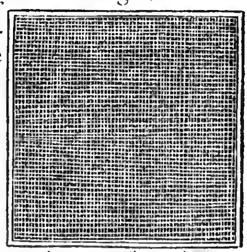
Paper may be divided into three distinct classes; viz. writing and drawing papers, printing papers, and wrapping or packing papers.

Fig. 1.



First, *Writing or drawing papers*—Writing papers are called either *laid* or *wove*, from the moulds on which they are made. Laid papers retain the marks of the wires in long parallel lines crossed at intervals by other lines, as shown by fig. 1, which is a mould for making laid papers. Wove papers, on the contrary, bear no impression of the wires, the mould used for making them being formed of very fine wire, woven in a manner similar to linen,—whence the derivation of the term *wove*. The appearance of a mould of this description is shown by fig. 2. Laid paper is generally of a bluish cast, which is obtained by adding smalt (the powder blue of commerce) to the pulp while in the vat. Wove paper is of two kinds,—blue wove, and yellow wove; the former of which is made by working the pulp to which smalt has been added, on a wove mould; yellow wove, on the contrary, is the pure colour of the rag, considerably heightened, however, by the process of bleaching. Drawing papers are always of the latter, and writing papers (emphatically so called, from imperial to demy) of the first named description. In describing the numerous varieties of post, copy, foolscap, and post papers, the distinguishing terms, *laid*, *yellow wove*, or *blue wove*, are always employed. But in all

Fig. 2.



papers, from demy upwards, *wove* and *drawing*, or *laid* and *writing*, are synonymous terms; and where no distinguishing term is used, *laid* is always understood. The following is a list of the papers in this class, with their dimensions, and weight per ream:*—

Name.	*Dimensions.*		*Weight.*
	In.	In.	lbs.
Antiquarian,	$52\frac{1}{2}$ by	$30\frac{1}{2}$	236
Double Elephant,	$39\frac{1}{2}$	$26\frac{1}{2}$	140
Atlas,	33	26	100
Colombier,	$34\frac{1}{2}$	23	100
Elephant,	$29\frac{1}{2}$	$21\frac{1}{2}$	72
Imperial,	28	23	72
Super Royal,	$27\frac{1}{4}$	$19\frac{1}{4}$	52
Royal,	$23\frac{1}{2}$	19	44
Medium,	$22\frac{1}{4}$	$17\frac{1}{4}$	34
Demy,	$19\frac{1}{2}$	$15\frac{1}{4}$	24
Extra large thick Post,	$22\frac{1}{4}$	$17\frac{1}{4}$	25
Ditto ditto thin ditto,			18
Ditto ditto Bank ditto,			13
Ditto large thick ditto,	21	$16\frac{1}{2}$	22
Ditto ditto middle ditto,			19
Ditto ditto thin ditto,			16
Ditto ditto Bank ditto,			11
Extra thick ditto,	19	$15\frac{1}{4}$	25
Ditto thick Post,			20
Ditto middle ditto,			17
Ditto thin ditto,			14
Ditto Bank ditto,			7
Copy,	20	16	17
Square Foolscap,	$22\frac{1}{2}$	$13\frac{1}{4}$	20
Extra thick ditto,	$16\frac{1}{2}$	$13\frac{1}{4}$	18
Foolscap,			15
Post,	$15\frac{1}{2}$	$12\frac{1}{2}$	10

Drawing papers are not made smaller than demy, and are put up into reams in the flat state. Writing papers, on the contrary, are seldom made larger than imperial, never larger than atlas, and are generally folded in half.

Considerable trouble has at different times been taken in attempting to discover the origin of the names which the several kinds of paper now bear, but without success. Another object of unsatisfac-

* A ream of paper consists of twenty quires; viz. eighteen quires of twenty-four unbroken sheets, and two quires of twenty sheets each, defective paper,—one of which is placed at the top, the other at the bottom of the ream, to preserve the inside paper from string marks, and injuries of any other kind. If the two outside quires are replaced by two perfect quires, the ream is stated to be *all insides*. A *printer's ream* consists of twenty-one and a half unbroken quires of twenty-four sheets each, and is called a *perfect ream*.

tory research, is the origin of the peculiar water marks with which each of the laid papers is distinguished.

The derivation of these marks, as well as the time at which they were first used, is mere matter of conjecture; but I am inclined to think, that on their first adoption, a closer relation existed between them and the names of the papers distinguished by them than at present. By a knowledge of these marks, the original size of any paper may be at once discovered, however much it may have been cut, or reduced in size. These remarks apply to the *laid* papers only; in *wove* papers the water marks being always omitted. The post papers are seldom retailed in the folio, *i. e.* the original size, as quoted in the foregoing list, being cut in half, and folded, and ploughed round the edges, forming quarto post, the common letter paper of the shops; this cut and again folded, &c. forms octavo post, or note paper, &c.

Having said thus much of writing paper, I next proceed to the second division of my subject,—*printing papers.* At the head of this extensive and highly useful class stand the plate papers. These papers are of the same size, weight, and quality, as the drawing papers already described,—differing from them, however, in being of a particularly soft nature,—the process of sizing, which gives the firmness so necessary in papers intended to be written on, being wholly omitted in the manufacture of plate papers. Plate paper is not made smaller than medium,—the size of the plates for a demy book. These papers are, as their name implies, used for copper-plate printing; when the plates are to be coloured, drawing paper is used, then technically called *hard plate*, in contradistinction to the former, or *soft plate.*

The following is a list of the other papers in this class, the weights and sizes of which vary greatly, according to the choice of the maker:—

Name.	*Dimensions.*		*Weight.*	
	In.	In.	lbs.	lbs.
Large News, - -	32	by 22	From 32	to 37
Small ditto, - - -	28	21	23	25
Royal, - - -	25	20	26	28
Medium, - - -	23½	18¾	24	26
Demy, - - -	22½	18	15	21
Short, (or Music,) Demy,	20½	14	25	28
Copy, - - - -	20¼	16¼	13	16
Crown, - - -	20	15	7	12
Foolscap, - - -	16½	13¼	9	14
Post, - - - -	15½	12¼	9	10½

The three last of these are generally made in the double size. Printing papers are generally of a yellow wove texture, and are not so well sized as the writing papers; but the sizing is not wholly omitted, as, without some portion of it, they would not possess sufficient strength for ordinary purposes.

I have now arrived at the third division of my subject, viz. *wrapping, or packing papers.* This class includes an almost endless variety of sorts and sizes; which, for the sake of perspicuity, I shall notice under the following heads; viz. cartridge papers—blue papers—hand papers—and brown papers.

I. *Cartridge Papers.*

Name.	*Dimensions.*			*Weight.*		
	In.		In.		lbs.	lbs.
Square Cartridge, -	33½	by	21½	From	47	to 50
Double Crown ditto, -	30		20		30	38
Elephant ditto, - -	28		23		48	52
Common size ditto, - -	26		21		40	50
Royal ditto, - -	24		19½		29	32
Demy ditto, - - -	22½		17½		26	28
Foolscap ditto, - -	16½		13¼		13	15

II. *Blue Papers.*

Name.	*Dimensions.*			*Weight.*		
	In.		In.		lbs.	lbs.
Blue Elephant, - -	28	by	23		30	
Ditto Double Crown, -	30		20	From	20	to 22
Ditto ditto Foolscap, -	26½		16		20	
Ditto ditto Royal, -	25		20		20	to 22
Ditto ditto Demy, - -	22½		18		15	18

III. *Hand (or white brown) papers.*

Name.	*Dimensions.*			*Weight.*		
	In.		In.		lbs.	lbs.
Elephant - - - -	28	by	23	From	30	to 36
Thick Royal Hand -	24½		20½		36	40
Thin ditto ditto - -	24		20		16	20
Curling - - - -	23½		19½		10	12
Lumber hand - - -	22½		18½		13	15
Middle ditto - -	22		17		12	14
Small ditto - - -	20		15		6	10

IV. *Brown papers.*

Name.	*Dimensions.*			*Weight.*		
	In.		In.		lbs.	lbs.
Imperial Cap - - -	29	by	22	From	60	to 84
Bag ditto - - -	23½		19½		36	48
Kentish ditto - - -	21		17½		26	28
Small ditto - - -	20		15		11	12
Double four Pound - -	32		20		56	66
Small ditto ditto - -	28½		17½		42	52

In addition to the above, there are a variety of papers for particular purposes, which do not come under any of the divisions hitherto noticed. I therefore proceed briefly to notice the principal of them, commencing with *blotting paper*, which is well known to every person. It is made of three different sizes; viz. medium, post, and foolscap, of various colours, weights, and quantities. Blotting paper, especially the colourless description, is much used in chemical experiments, for the purpose of filtration; there is, however, a distinct kind of paper made for this purpose, and known by the name of *filtering paper;* it is generally made double crown size, of a thick woolly texture. *Tissue paper* is also too well known to need description, beyond stating that it is made the size of crown, double and single, and demy. A particular species of tissue paper is manufactured and sold under the name of *copying post;* it is wholly destitute of size, and is of a thin absorbent texture; its use is for copying newly written letters. For this purpose it is slightly moistened, and laid on the letter written with *copying ink*, and is subjected to the action of a press, kept in counting-houses for that purpose; on removing the letter from the machine, an accurate facsimile is found transferred to the copying paper, which, pasted into a book, answers all the purpose of the more tedious and laborious methods of transcribing hitherto practised. *Littress* is a kind of smooth cartridge paper, made of two sizes, royal and foolscap, and used wholly for the manufacture of cards. Among the various kinds of paper used by grocers, in addition to many of those already described, there is a thick purple paper, which forms a distinct class, under the tile of

Sugar blues, viz.—

Name.	*Dimensions.*		*Weight.*
	In.	In.	lbs.
Large Lump - - - -	$22\frac{1}{2}$ by	32	108
Small ditto - - - -	$28\frac{3}{4}$	$21\frac{3}{4}$	102
Single Loaf - - - -	$26\frac{3}{4}$	19	90
Powder ditto - - -	26	18	58
Double ditto - - - -	22	$15\frac{3}{4}$	44

There are a species of thick brown papers, made for particular purposes; among which may be placed a large coarse paper for strong packing purposes, known by the name of *Manchester papers; sheathing paper* for ship-builders, and *tip paper* for hatters, are also of a similar description.

It is necessary here to observe, that although I have made a very marked distinction, in the mode of classification which I have adopted, between the two classes of printing and wrapping papers, yet such, in reality, does not exist; as, in some cases, the finest printing papers are applied to wrapping purposes, and many of that class (as regards size, &c.) are made of an inferior quality, for the purpose of wrapping papers,—such, for instance, as the double

crowns and demys used by grocers, hatters, &c. &c. In hand papers, again, some irregularity occurs;—elephant, which stands at the head of that class, is almost exclusively used for the manufacture of paper hangings, and is made of various qualities, according to the description of work for which it is intended. The elegant crimson and satin hangings require a paper of the best printing quality; which will not, therefore, with propriety, come under the denomination of *hand paper*. But had these and similar particulars been allowed to interfere with the arrangement I have adopted, much confusion and unnecessary repetition would inevitably have resulted. I have, therefore, given the most usual weights and sizes, which remain much the same, in whatever class the quality of the paper may chance to place it.

Coloured papers is the title of an exceedingly numerous class, which divide themselves into two kinds; viz. those which are made at the paper mill, either by colouring the pulp while in the vat, or by dying the paper afterwards; and those which are made from white papers, by persons following the business of fancy stationers and coloured paper manufacturers. Among the former class we may reckon the coloured drawing papers, for mounting, &c. crayon papers, for draftsmen; coloured printing demy, royals, &c. for the covers of books; and the beautiful tinted post and tissue papers, in such high repute with the fair sex. The second class comprises, in addition to several of the above, coloured double crowns, demys, &c. for posting-bills; coloured foolscaps,—marble, cypress, morocco, with gold and silver papers; as also papers in imitation of the various kinds of woods, tortoise-shell, &c. &c. to which I may add, a paper most beautifully executed in imitation of buhl work. Indeed, the beauty and variety of the papers in this class is such, that to be duly appreciated, they must be seen. Description, were I to attempt it, would be injustice to them.

Several papers are frequently made in the double size,—as was noticed when speaking of printing papers. The dimension of papers, in the double, may be obtained by doubling the smallest admeasurement. Thus, crown, for instance, is 20 inches by 15 inches, and double crown 30 inches by 20 inches, and so with all others.

Hoping at some future time to resume the subject, with an account of the manufacture of paper, and some of the manipulations it afterwards undergoes,

I remain, sir, yours, &c.

Wm. Baddeley, Jun.

Improvement in Watches, being an Account of a new Metallic Alloy for the Pivot Holes of Watches. By Mr. J. Bennet.

In a machine so minute and complicated, and requiring such exactness of movement, as a watch, it is evident that whatever tends to increase or overcome the friction of the different parts, deserves careful and serious attention. At no part of a watch or clock is the

quantity of friction of greater consequence than at the pivots, and the holes in which they work. The former are required to be smooth, properly proportioned, and also to be hard, to admit of being as slender as possible; and the latter should be made in such a material, as will generate the least possible friction, be hard enough to prevent the side pressure of the pivot from altering the shape of the holes, and be acted upon as little as possible by the acids, that the oil may be preserved in a pure state.

When watches were first invented, the holes in which the pivots worked were made of brass, and the plates were polished. It was found that the plates tarnished, from the action of the air, and rendered the general appearance of the watch very unsightly; and that the oil in the holes had a tendency to become impure from the action of *acids* on the brass. Gilding the plates was then resorted to, but with these disadvantages; it softens the plates, and, consequently, the holes; and the nitric acid, mercury, &c. used in gilding, has a very injurious effect on the pivots and oil. Both of these methods having their advantages, and disadvantages, it is difficult to say which is the better of the two.

Ruby, or garnet holes, were then substituted for brass holes; and, by many, these have been considered the *ne plus ultra* of this part of watch-making—a watch being considered valuable in proportion to the number of holes it has jewelled. But experience proves, that when a hardened steel pivot works in a ruby, or garnet hole, the friction may, from a variety of circumstances, be materially increased, instead of diminished by the hole. If it were possible, in *every case*, to have the two surfaces of the steel pivot and ruby hole perfectly smooth, the friction would be but trifling; but it is often very difficult to obtain this, even in the best jewelling. If there should be but the smallest imaginable part of the ruby hole unpolished, the action of that unpolished part on the pivot would be precisely the same as a common grindstone on a chisel or knife; consequently, there would be two rough surfaces rubbing each other, and, thereby, the friction would be very much increased; and ultimately the pivot, being the softer of the two, would be destroyed. The pivots which are nearest the maintaining power, and the balance staff, especially if the balance be heavy, are most affected by bad jewelling, by reason of the greater side pressure they sustain. From this cause proceeds the harsh rubbing sound of the balance staff observable in some jewelled watches. Hence, many of the most eminent watchmakers jewel only in the staff and scape wheel holes. Those who have been accustomed to repair watches with a number of holes jewelled, will have had abundant evidence of the truth of these observations. Mr. Bennett mentions two instances, out of a great number, which came under his observation, as, in them, the objection of bad jewelling, in the ordinary sense, could not be reasonably brought. He repaired, in November, 1829, a celebrated watch given to H. Brougham, Esq. M. P. by the working watchmakers of Liverpool, which is jewelled in every hole. As it is considered to be a specimen of the finest work the art of Liverpool could produce,

it is fair to suppose that they would pay particular attention to the jewelling, which certainly is very valuable, both as regards the fineness of the stones, and the beauty of the workmanship. He found that every one of the pivots were cut and threaded by the jewelling, but more especially those nearest the maintaining power; and the polished surfaces of the pivots having been worn off by the roughness of the jewel holes, the dirt, &c. which the oil had collected stained the pivots as black as ink. Now, a watch in this state, is infinitely worse than one with common brass holes, as the only remedy is to have new pivots and holes, the expense of which would be almost equal to that of a new movement; not to mention the gradual increase of friction and consequent continual change in the rate of performance of the watch. The other instance, was a very superior carriage watch, by Tregent, made for the late Duke of Kent, and now in the possession of the Duke of Sussex, in which the staff pivots were nearly cut through by the jewel holes, it having a *very heavy balance.* This illustrates a foregoing observation, that, in proportion as the side pressure the pivots sustain is greater, jewel holes tend, *above any other*, to increase the friction. A new staff was put to this watch, and the same process went on.

Watches have been made with steel holes, but these have never answered the purpose, for several reasons; principally, on account of the constant liability to attraction, between the pivot and hole from magnetic influence, the friction caused by two metals of the same kind rubbing each other, and the disposition to oxidize.

Gold has also in some cases been used, but, by reason of its softness, it is objectionable both on account of the side pressure of the pivot, and the difficulty of getting a perfectly round hole.

What appears to be wanted to obviate the objections to which the holes above mentioned are liable, is, to obtain a *metal* that shall preserve the oil in a pure fluid state, be subject as little as possible to friction, and be *softer* than the pivot, for, it is of more consequence to preserve uninjured the pivot than the hole. Mr. Bennett tried various metals both simple and compound, to procure one having these advantages:—

Platina he found objectionable on three grounds; viz.—difficulty of working;—deteriorating effect upon the oil;—and too soft to bear the side pressure of the pivots.

An alloy consisting of 3 dwt. of pure gold, 7 grains of silver, and 8 grains of steel, proved too brittle, and to possess a very coarse grain. Another alloy, prepared nearly similar to the foregoing, but having the addition of 3 dwt. 18 grains of platina, and 1 dwt. of copper, was found to have analogous properties.

A compound of 1 dwt. pure gold, 1 dwt. copper, ½ dwt. silver, and 6 grains zinc, proved very malleable, was nearly as hard as brass, and produced much less friction.

The following alloy, however, proved eminently successful; viz.— 3 dwt. of pure gold, 1 dwt. 20 grains of silver, 3 dwt. 20 grains of copper, and 1 dwt. of palladium. The palladium readily united with the other metals, and the alloy fused at a temperature rather

below that required for melting gold in a separate state. It was very nearly as hard as wrought-iron, and not so brittle but that it could be drawn into wire. Its colour was a reddish brown. Its grain on breaking as fine as steel. It takes a very beautiful polish; and the friction with steel was very much less than that of brass and steel, or the previously mentioned alloy with steel. It works well. Nitric acid has no sensible effect upon this alloy. Mr. Bennett has constructed a watch, and made the holes of this metal, and it answers fully his expectations, as regards its degree of hardness, its suffering the oil to remain in a pure fluid state, and its little susceptibility of friction. It produces much less friction than the jewel hole, especially supposing the jewel not to be perfectly well polished; besides that, it will not *wear the pivot* nor be affected by the acid particles which may be contained in the oil. And with regard to expense, it has a decided advantage over the jewel hole,—as the expense of jewelling all the holes of a watch would be from £6 to £9, whereas the same number of holes may be made of this metal for as many shillings. [*Register of Arts.*

The Chemistry of the Arts, being a practical display of the Arts and Manufactures which depend on Chemical Principles, on the basis of Gray's Operative Chemist. By Arthur L. Porter, late Professor of Chemistry in the University of Vermont. *Carey & Lea,* 1830.

[Concluded from page 68.]

The Liming.

For this purpose take one bushel of good quicklime, and reduce it by slaking to a dry powder; introduce it into a vessel capable of containing from 60 to 80 gallons, (a common rum puncheon answers a good purpose,) and fill it with water; agitate the mixture by stirring, till it acquire the consistence of milk; lay into the bottom of the keir a stratum of cloth, having the bands of the folded piece previously made very loose, and while one man is employed in stirring the lime mixture, let another dash a bucket or two of it over the cloth, which being previously wet, absorbs the liquid very readily; let another layer be put in and wet down with the lime mixture, and so on till the operation is completed. As the mixture gets low, and of a thicker consistence in the lime cask, more water must be added till the lime is all used, and the cloth all in the keir; it is better, indeed, to add a fresh bucket of water to the mixture for every bucket that is withdrawn, till towards the very last of the lot. The manipulations in this stage of the business will be very easily comprehended when it is understood that the object is to diffuse a bushel of lime as equally as possible through a quantity of water sufficient to fill the keir to the grating, upon which the cloth rests, which will require from 300 to 400 ale gallons, and to spread this mixture evenly over the cloth. The agitation of the lime liquor must not be so violent as

to keep suspended any lumps of lime that may remain in the powder after slaking, which must be rejected at the last; for such is the activity of this agent, that it is sure to endanger the fabric where it is allowed to remain in any considerable quantity in contact with it during the boil. The cloth should be heaped a little about the vomiting pipe, so that the liquor as it falls from the pipe may subside more towards the side of the keir than it otherwise would do; much, however, depends upon the exact form of the pipe, and the violence of the ebullition; it should be the bleacher's aim to watch the boiling carefully, and adopt such little expedients from time to time as may ensure a regular and even distribution of the liquor over the surface of the cloth, and percolation through it; this is important in all the boilings, but particularly in the liming, where, owing to the very sparing solubility of the lime, an uneven distribution of the liquor may not only fail to produce the necessary effect upon some unexposed portions of the goods, but, by an unequal deposition of the solid particles of lime, produce such an accumulation upon other portions as to injure the texture. The fire may be kindled under the keir as soon as the first layer of cloth is introduced, and wetted with the lime liquor. The boiling should be kept up briskly, at least eight hours; ten hours boiling will not endanger the cloth;—it is a good rule to boil in this as well as in the subsequent buckings in potash nine hours.*

As soon as the boiling is completed, the goods may be cooled

* The whale boiler, or keir, so called, is now almost universally adopted in bleacheries, both in England and the United States. The bottom is composed of iron or copper, with a broad horizontal flanch turned up at the outer edges, to which a wooden curb is attached by bolts and nuts. This curb is usually made widest at the top; the dimensions of a curb for boiling 30 cwt. of cloth, are usually 7 feet deep, 6 feet diameter at bottom, (that is, the grate upon which the cloth rests,) and 7 feet at the top. The bottom part should have a capacity of 300 to 400 gallons. A vertical metallic tube, 5 inches diameter, and open at both ends, is firmly attached to the grate by a side flanch, and terminates below the grate within two or three inches of the bottom of the keir, and above the grate within six or eight inches of the top of the curb. This tube is generally made too small, and does not allow the liquor to pass up as freely as it should do. But the particular object of this note is to point out the advantage of reversing the form of the curb, and placing the largest diameter at bottom, and the smallest at top. The object of this change in the form is to obviate a difficulty which bleachers often experience in the common keir, that of the goods rising in the curb, and pressing up the cover, to the great loss of heat, and sometimes to the complete defeat of the boiling; for after the cloth has once risen in this way, it is very difficult to get it back again till the keir is cooled down. I have tried the change proposed with great advantage, and indeed with complete success, in obviating the difficulty mentioned.

With regard to the question, whether the employment of steam, or the direct application of fire to the keir be most advantageous, I do not consider it an important one, but prefer the latter; first, because a little higher temperature may in this way be obtained than can be conveniently obtained by steam; and, secondly, because the apparatus may be constructed at a less cost in the first instance, and maintained at less expense for repairs. I need scarcely add, that where steam is employed for this purpose, that the keirs may be constructed wholly of wood.

down by the admission of cold water, and removed from the keir. When taken from the keir the pieces are to be loosed from the band; edged up, (that is, pulled over from end to end by one selvage to shake out the folds and *crimps*,) and carried to the dash wheel. Owing to the insolubility of the lime, the washing out of this boiling requires greater attention than from any other. Some bleachers edge up and wash a second time before the potash boil; but this is unnecessary. If the dash wheel be well supplied with water, ten minutes washing is generally sufficient for any purpose; the best criterion, however, by which to judge of the amount of washing required out of either the lime or the potash boiling, is the colour of the water which runs from the dash wheel; when this ceases to be muddy, or discoloured, we may safely infer that the washing has been sufficient. From the dash wheel the pieces are thrown again into bundles, preparatory to the

First Potash Boiling.

Dissolve in an iron kettle, by heat, 100 lbs. of the best American potash, in 25 gallons of water; add to this solution while hot, 25 lbs. of fresh slaked lime, and stir the mixture half an hour; allow it to stand till the sediment subsides, and then lade off the clear liquor into another clean iron vessel. This is a standard potash ley, each gallon of which contains four pounds of potash, and should have a specific gravity of 58° Tweedale's hydrometer. Put 16¾ gallons of this solution into the boiling keir, and add water till it stand 6 to 8 inches above the grate; kindle a fire under the keir and lay in the cloth with the bands of the bundles quite loose; proceed in the boiling in all respects as in the boiling in lime, and keep up a brisk ebullition 8 or 9 hours. It is usual to put the goods into the keir in the morning, and, after boiling, to allow them to remain in it over night, and cool gradually. This will answer very well in the potash boiling; but after the boiling in lime, I should hesitate to allow the cloth to lie in the keir over night without being previously cooled down by the admission of water. In cases of great urgency, it is practicable to buck twice in twenty-four hours.

From the boiling keir the cloth is again returned to the wash wheel. It is not necessary to edge up the pieces in this washing. The liquor remaining in the keir after boiling is very dark coloured, and surcharged with the colouring matter of the cloth; it has lost in a great measure its causticity; if muriatic acid be added to a portion of this liquor, the colouring matter is precipitated of a dark greenish hue. By evaporating this residuum liquor till it acquire the consistence of thick treacle, and then exposing it to the heat of a reverberatory furnace; the vegetable matter may be burned out and dissipated, and the alkali recovered in the form of pearl ash, or the subcarbonate of potash. This was formerly practised in England, but has, I believe, now fallen into disuse. The expediency of it depends wholly on the relative value of the alkali on the one hand, and of labour and fuel on the other. Where fuel and labour are comparatively cheap, and the alkali high priced, as in Lancashire in Eng-

land, this may, in some instances, be an economical practice; but where the reverse of this is true, as in the United States, the product would scarcely reward the attempt. After washing, the cloth is allowed to drain, and is then prepared for the solution of chloride of lime.

Blanching Liquor.

The solution of the chloride of lime is known to English workmen, and, I believe, very generally to our own, by the vulgar appellation of *chemic*, a term scarcely to be tolerated in a work having the least pretensions to scientific propriety. As a popular name, however, seems almost indispensable in a treatise designed for practical men, I shall designate it by the more appropriate appellation of *blanching liquor*. It is prepared by adding 50 lbs. of the best chloride of lime, or bleaching powder, to 50 gallons of water, stirring the liquor occasionally for ten or twelve hours, and then leaving it to settle; it is most convenient to commence this process in the early part of the day, and allow the liquor to stand over night; by this means a firmer sediment is obtained, and the clear liquor is more perfectly separated from it. Add this clear solution to a sufficient quantity of water for covering the lot of cloth, (2000 lbs. as before mentioned.) The goods are to be immersed in this liquor, and particular care must be used that the bands be quite loose, and that the quantity of liquor be sufficient to cover the pieces without compressing them too hard. This solution is not so penetrating as the acid liquor, and the cisterns should have a capacity compared with the cisterns for the sours, as 4 to 3, in order that the cloth may be more fully exposed to the action of the liquid. Two thousand pounds of cloth will require for the solution of chloride of lime a capacity of about 360 cubic feet, and for the sours 270. The cloth should remain in the blanching liquor about 10 hours. It is then thrown upon a grated wooden flooring which extends about one-half the cistern, and after draining an hour or two, is ready for

The First, or Brown Sours.

Fill the cisterns for the reception of the goods to within three-fourths of their depths of the top with water, and add to it 40 lbs. of concentrated oil of vitriol, and stir the mixture well till the acid and water be thoroughly incorporated. The liquid will then have a specific gravity of $1\frac{1}{2}°$ or $2°$ on Tweedale's hydrometer, and a degree of acidity to the taste, about equal to that of lime or lemon juice. As the souring liquor is not often entirely changed, no very exact rule can be given for replenishing the cisterns with acid; as a general rule, however, 40 lbs. of concentrated vitriol per ton of cloth for each souring will be found sufficient. The specific gravity may be some guide, but this is liable to be influenced by other matters derived from the cloth. On the whole, the taste is the surest guide for the practical bleacher. Goods are rarely injured by too strong sours, if proper precaution be taken to prevent any parts of them from drying with the acid in them; if this precaution be neglected,

the destruction of the fabric is certain;—the reason is obvious,—if the cloth dry with the souring liquor in it, the watery parts alone evaporate, and from being impregnated with a very diluted, it becomes intimately united with a highly concentrated acid; on this account it is always better where the goods cannot be washed out of the sours, after the usual time, to allow them to remain in the liquor, in preference to leaving them long exposed to the air; or, if it be necessary to withdraw them from the liquor to make room for another lot, they should be kept wet and excluded as much as possible from the atmosphere. Damage from this source is always to be suspected where certain circumscribed spots of bleached cloths are observed to be tender, while the general texture of the fabric is sound. Ten or twelve hours immersion in the sours is sufficient, but an hour or two, more or less, is not material. After draining, return the goods to the dash wheel.

Second Potash Boiling.

The method of proceeding in this is precisely the same as in the first boiling in potash, except that only one-half the quantity of potash is used. The boiling, washing, blanching, and souring operations, are repeated in the same order and manner as already described. As the goods are, however, become more free from colouring matter, it is important that the second souring and blanching operations should be performed in separate cisterns; these cisterns are generally called by the workmen the *white chemic* and *white sours*, in contradistinction from the first liquors denominated the *brown* chemic and sours. The liquor of the brown sours should be changed after every 20 or 30 operations; but those of the other cisterns not oftener than once a year, if proper precautions be taken to preserve them from accidental impurities. Great care should be used that the cloth be thoroughly washed out of the last sours; for, if any acid remain in the cloth when dry, it certainly will be injured. In all the other washing it is usual to wash two pieces in each compartment of the dash wheel; but, in order to ensure a perfect washing out of the last sours, it is better to put only one piece in a compartment.

After the last washing the goods are passed through a trough of clear water, squeezed, and dried.

The order of the processes, then, as described in the foregoing remarks, are summarily these:—

1. Steep.
2. Wash.
3. Boil in one bushel of lime.
4. Wash and edge up.
5. Boil in 67 lbs. of potash.
6. Wash.
7. Immerse in a solution of 50 lbs. of chloride of lime.
8. Immerse in sours containing 40 lbs. of oil of vitriol.
9. Wash.
10. Boil in 33 lbs. potash.

11. Wash.
12. Immerse in the solution of chloride of lime.
13. Sour as before.
14. Wash.
15. Rinse and squeeze.

The whole amount of materials used is one bushel of lime, 100 lbs. of potash, 50 lbs. of chloride of lime, and 40 lbs. of oil of vitriol for 2000 lbs. of cloth.

Improved gearing Chain.

An ingenious and useful construction of gearing chain for connecting cog wheels, has lately been invented by Mr. Oldham, engineer, of the Bank of Ireland, which we think highly deserving of the attention of machinists, as it is so extensively applicable to various kinds of machinery, such as carding engines; and indeed in almost every situation where a series of toothed wheels are required to be driven by one mover. It consists of a peculiarly constructed chain, with curved links, which when passed round a drum will serve as teeth, and act as a cog wheel to turn pinions, &c. and when stretched out straight, or placed on a flat surface, will form an endless rack. It may also be passed over and under a series of rollers, pinions, &c. forming a carrying chain instead of the commonly constructed chains, in which spiked wheels are employed to take into the links.

In carding engines, and various other kinds of machinery, this improved chain will work with much better effect in connexion with pinions, or wheels with common teeth, into which it is suited to gear, than the old chains, and without the possibility of slipping off, or riding over the points of spiked wheels; having a broader surface of contact: and it is not at all liable to get out of order, being much stronger than the old linked chain used with spur pinions.

Fig. 1.

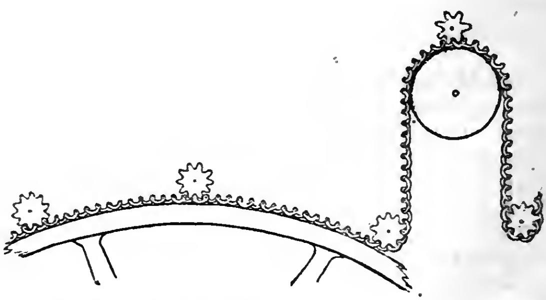


Fig. 3.

Fig. 2.

Fig. 1, is a side view of a portion of the improved chain. Fig. 2,

is a plain view of the same; it is formed by crescent shaped plates constituting links, which are connected together: one and two plates alternately, or two and three, or more placed side by side; the alternate links fitting in between each other at the joints, where they are connected by pins, or bolts passed through their eyes in lateral directions.

It will be seen that these curved links present on one surface of the chain semicircular hollows like a rack, for the teeth of the pinions to take into, and that the ends of the links, where the bolts or rivets are passed through are also formed semicircular, and the same size as the spaces or hollows of the links. These ends constitute teeth on the chain, and take into the spaces between the teeth of the pinions or wheels, and consequently drive them; or the chain itself may be driven by such pinions or wheels in the same way as a rack.

It is obvious that such a chain may be passed in various directions over wheels, on its face, and over drums at its back, and may be used with certainty of effect: as whatever motion is given to the chain, will be communicated to all that is in gear with it.

Fig. 3, shows such a chain, supposed to be endless, carried over part of the periphery of a carding cylinder, and constituting a circular rack or tooth rim, which drives all the pinions connected to it; the back of the chain is conducted over a roller, and brought into gear with other pinions or wheels; but as numerous illustrations might be produced of its applicability, it is unnecessary to say more, as its adaptation to a very wide range of machinery will at once be perceived by every practical mechanic.

Improved mode of coupling Machine Bands or Straps.

Mr. E. Budding, of Stroud, Gloucester, the recent Patentee of an ingenious machine for mowing lawns, has lately invented a new mode of uniting the ends of leather straps or bands, employed in driving machinery, which, from its simplicity and perfect security, will beyond all doubt, be adopted in every mill and manufactory where leather strapping is made use of, instead of lacing, thongs, rivets, or buckles.

In some mills where very long bands or straps are used, it is customary to secure the several pieces together by rivets, to form the whole length of strap; and to attach the two extreme ends by lacings, so as to allow of adjustment. This mode of fastening is objectionable, as the hammering of the rivet, unless very carefully done, is liable to bruise and injure the leather, and frequently causes it to break at such parts when in use; beside to make a secure joint, many rivets must be used, which is both expensive and troublesome.

Fastening straps with lacings or thongs is also objectionable, as they require many holes to be pierced through the straps, which weakens them, and when they require adjusting, a considerable time is lost in unlacing and lacing them again, to take up a hole; during

which time the machinery must stand still: and the lacings, in passing over the drums, are often cut, and very soon wear through, thus producing delay and expense, and injury to the machinery. These disadvantages are so well known to all practical men, who have the superintendence of machinery, that we feel convinced any attempt to obviate them will be acceptable to our readers.

Mr. Budding's plan consists in employing studs, or metallic buttons, the shanks or stems of which are hollow sockets, having a female screw cut in them. The stem or shank is as long as the thickness of the two pieces of strap when combined, and is made truly cylindrical, fitting the holes punched in the straps at the proper places of union. When the holes in the ends of the strap are brought together, the socket or shank of the stud is introduced through them, with the button or disk on the underside, and a screw with a large flat head is screwed tightly into the socket of the button, which compresses the leather between the button, and the screw head, as it becomes tightened up, and keeps the two pieces in close contact, producing a tight and secure joint; the strap being as pliable at the junction as at any other part.

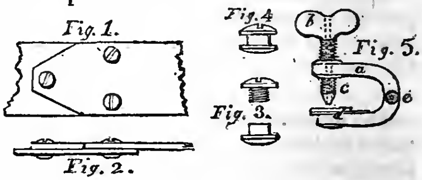


Fig. 1, is a view of the two pieces of strap fastened together, as seen on the upperside; Fig. 2, is an edge view of the same; Fig. 3, is a representation of the button or disk with its socket, rim, and the top screw, separated from each other; Fig. 4, a representation of them when put together.

When two pieces of strap are to be united, it is only necessary to punch the holes of the proper size, to suit the stem of the button intended to be used, and on bringing them together, the socket is to be introduced through them, and then the large headed screw introduced into the socket and screwed tight up.

It is obvious that this operation will take but little time, and a strap can be unfastened and a hole let out, or taken up and fastened again in a few seconds.

Straps of considerable strength and thickness, will require different sized buttons and stems, according to the rate at which they are intended to work. They are generally used three together for securing one junction of the straps, for all ordinary purposes of machinery; but for a steam engine strap perhaps five may be required: more than five is seldom necessary, unless to an engine of very great power.

The operation of attaching the straps by these studs is greatly facilitated by the use of a punch of a rather novel construction, likewise invented by Mr. Budding, the form of which is shown in Fig. 5. It consists of a clamp *a*, through which is passed the thumb screw *b*, on the lower end of which is the punch *c*. When the straps are adjusted, they are held between the clamp as at *d*, and the

thumb screws turned round, when the punch will cut a perfectly clean hole through both straps at once.

On the band of the clamp is the concave piece of steel *e*, which is file cut on its surface; when the socket of the button has been introduced into the hole, this concave piece is placed against the button, at the underside of the strap, and held in contact with it, while the screw is driven up tight; the rough file cut surface preventing the button from slipping round. Different sized punches may be fitted to the thumb screw or clamp, to suit the sockets of the different sized buttons, some of which are made small enough to connect the leather straps of carriage harness, and it would be very advantageous if stage coachmen and guards were to carry a few of these buttons in their waistcoat pockets, in case of accident.

These studs are sold from 3*s.* to 4*s.* 6*d.* per dozen, according to the size.

First Steam Communication with India.

[From the United Service Journal.]

It has for some time been a favourite object of sir John Malcolm, governor of Bombay, to establish a steam conveyance for despatches between that place and England, *via* the Red Sea, Suez, and Alexandria. A vessel called the *Hugh Lindsay*, of 400 tons burthen, with two engines of eighty horse power each, was accordingly built for this purpose, at an expense of at least 40,000*l.* Though constructed upon such a costly scale, yet the unaccountable blunder was committed, of her not having capacity to carry more than six days' coal; when it is impossible she could reach the Arabian coast from India in less than eight or ten days. If every thing, however, had been properly managed, the mails might have reached Alexandria in twenty-three days; from thence to Malta would have occupied four days more; thence to Marseilles four days; thence to England five days: total from Bombay to London, under favourable circumstances, only thirty-six days! As it was, the *Hugh Lindsay*, commanded by Captain Wilson, sailed from Bombay, and reached Suez in thirty-three days, having lost twelve days in the ports of Aden, Mocha, Judda, and Cosseir, being detained in getting supplies of coal on board at those places. The letters sent by this vessel, after all, reached England in less time than any were ever received before from India. Col. Campbell was the only passenger by her, probably from want of room, as the cabin and every other place was occupied by the coal. She was so deep in the water on leaving Bombay, that she was *à fleur d'eau*, and her wheels could hardly revolve. The distances between the several places on her route are as follow:—

From Bombay to Aden,	- -	1710 miles.
Aden to Mocha,	- - -	146
Mocha to Judda,	- - -	556
Judda to Cosseir,	- - -	430
Cosseir to Suez,	- - -	261
		3103

which, at twenty days' navigation, would give 155 miles a day, or six miles and a fraction per hour. The despatches by steam, therefore, ought to go from Bombay to Cosseir in fifteen days; from thence to Alexandria by a dromedary *direct*, without stopping at Grand Cairo, seven days; Alexandria to Malta four days, and so on as before mentioned, making in all from Bombay to England thirty-six days; or allowing for casualties, the mails might fairly be considered due in forty days.

We have been favoured with an inspection of the following letter from an officer belonging to the *Hugh Lindsay*, detailing the operations of that vessel in this first attempt to establish a steam conveyance upon that sea, where the Lord opened a path for the Israelites of old, and where the proud Pharaoh and all his host so miserably perished. Surely, no subject can be more generally interesting, not only to the people of Great Britain, but to every nation of Europe:—

"Sir,—I have much pleasure in acquainting you with the arrival of the *Hugh Lindsay* at Suez, this day, from Bombay, which place she left on the 20th of March. The passage has occupied more time than was expected, owing to the delay occasioned by receiving coal at Aden and Judda. At the former place we were detained *six* days, and at Judda *five*. We also touched at Mocha, which detained us a day. The present trip being an experiment, I was instructed, if time permitted, to visit you at Alexandria, for the purpose of communicating with you on the subject of steam navigation in the Red Sea; but the season being now so far advanced, it is necessary we should use the utmost despatch to ensure our return to Bombay, previous to the setting in of the southwest monsoon, for which reason we shall leave Suez as soon as we have received what coal there is. We touch at Cosseir to take what fuel is there also, and we are apprehensive we shall find scarcely enough on the Red Sea to take us to Bombay.

"The *Hugh Lindsay* is 411 tons burthen, and has two 80 horse engines. By the builder's plan, she appears to have been intended to carry about six days' coal; but, in order to make the passage from Bombay to Aden, she was laden as deep as could be, and left with her transom in the water. Notwithstanding, on our arrival at Aden, after a passage of eleven days, we had only about six hours' coal remaining; which circumstance alone shows her unfit for the performance of the passage. Her being so deep, too, materially affected her speed. I met with greater detention in getting off coal at Aden and Judda than I had anticipated. Arrangements might be made

to expedite the shipment of coal at those places, but I am now of opinion the fewer depots the better, and that if steamers were built of a class that would be propelled by engines whose consumption would not exceed nine tons of coal in the twenty-four hours, and which should carry conveniently fifteen days' coal at that rate of consumption, then the navigation of the Red Sea would be best carried on in two stages, one from Bombay to Aden, and from thence to Cosseir or Suez direct. I think, too, there is no necessity for proceeding up so far as Suez, as every object might be equally well attained by going to Cosseir only. As far as the passengers are concerned, the majority I should suppose would prefer being landed at that place, for the purpose of viewing the antiquities on the route from thence to Alexandria, and the arrival of despatches would be very little delayed, when we take into account the time occupied by a steamer, on going from the parallel of Cosseir to Suez, which, when northwest winds prevail, could not be done in less than two days and a half.

"I enclose a copy of the log of the *Hugh Lindsay*, from Bombay to Suez, conceiving it might possess some interest, as the journal of the first steam vessel which has ever navigated the Red Sea.

"I am, sir, &c.

"*Hon. Company's Armed Steamer, Hugh Lindsay, Suez, April* 22, 1830."

On the Resistance of Lead to Pressure, and on the Influence of a small Quantity of Oxide upon its Hardness.

The recent experiments of Mr. Bevan on the compression of lead,* and his proposal of applying balls of that metal to estimate the force of presses, screws, &c. must be well known to English readers. A similar investigation has been entered into by M. Coriolis, which, however, is much more refined as regards those circumstances that enable the lead to resist the force applied.

The points at first under investigation by the latter philosopher were temperature, time, impact, and state of the surfaces between which the lead was confined. The pieces of lead were cylinders 24 millimetres in diameter, and 19 in height; weighing each from 100 to 101 grammes. The arbitrary scale of measurement used gave 680 divisions for the 19 millimetres of height. The lead was pressed between two plates of iron in a kind of box, allowing lateral enlargement as the pressure was exerted, and the measurements of thickness were taken by means rendering the estimation very delicate.

To remove any irregularity resulting from differences in the times of pressure, it was in all ordinary cases limited to an exact minute. To ascertain the effect of impact, two pieces, which had been pressed

* Quarterly Journal of Science, N. S. vol. vi. p. 392.

equally, were then re-pressed, the one for two minutes, the other also for two minutes, but at eight different operations. On making thus the effect of impact eight times as much in one case as in the other, still the whole difference was only 19 divisions, which, divided amongst the extra 7 impacts, gives only about 3 divisions for each. As to the original temperature, its effect amounts to little or nothing; for when the cylinders were purposely cooled down, the mere effect of compression evolved so much heat that they could scarcely be touched, and this heat soon overpowered the original difference: experimentally no sensible difference was produced. In reference to the influence exerted by the state of the surfaces between which the lead was pressed, this also proved to be insensible.

In the experiments the results are always expressed by the number of divisions to which the thickness of the lead has been reduced from the original standard thickness of 680 parts; and in this abstract we shall only give the mean results. Under the following pressures the ordinary lead used in mints was reduced to the expressed thickness.

Kilogrammes - -	1500	1824	1950	3175
Thickness - - -	463	336	337	296

When this lead was re-fused and cast, it was found to have increased so much in hardness, as with 1500 kilogrammes to give 490 degrees.

Lead was then reduced from the carbonate, and tried after being fused and cast once, twice, thrice, &c. care being taken as much as possible to prevent oxidation by the use of tallow, charcoal, &c. upon the surface. By the pressure of 1950 kilogrammes it was, after the first fusion, reduced to 333 degrees; after the second to 351; after the third, to 398, always setting off from the standard thickness of 680.

This effect was referred to a small quantity of oxide introduced into the lead at each time of pouring. To ascertain the truth of this opinion, a stopcock was attached to the bottom of the melting vessel so that the lead could be drawn off without any contact with the atmosphere, the surface above being covered all the time with a thick layer of charcoal powder. Then the former experiments being repeated, it was found that lead, after the first fusion, was reduced to 303, less than on any former occasion; after a second, to 311; and, after a third, to 301; so that now no repetition of fusion produced any effect. Some of the lead was also cast in this way, being first raised to a cherry-red heat, and others only to the lowest point necessary for liquefaction. The effects were the same in both; no influence had been exerted over the hardness of the metal, and the changes which usually occur are due to a little oxide introduced.

In experiments upon the influence of time it was found that, after a minute had elapsed, the effect of time was masked by the general effect of the metal, and nearly hidden. For a charge of 1950 kilogrammes the compressions were as follows:—

Time -	30″	45″	60″	75″	90″	120″
Thickness	365	331	322	321	319	313

So that here, after a minute, 10″ produced an effect of only 2 degrees upon the scale. Still it was found the effect did proceed; for with a charge of 1760 kilogrammes the effect was as follows:—

Time - - -	1 minute	1 hour	24 hours
Thickness	317	245	223

So that after 24 hours, the lead still continued to give way.

The most important conclusion from these experiments is, that lead fused and cast in the open air is of variable hardness, and that to obtain it with its true and constant power of resistance, it must be cast out of contact with the air, and drawn off from the bottom of the mass.* [*Journal of the Royal Institution.*

Resistance opposed to Water moving in Pipes.—(D'Aubuisson.)

Notwithstanding the endeavours made to deduce formulæ from experiments on the passage of water through tubes, so as to assist and guide the engineer in laying down pipes to supply manufactories or towns, yet frequent mistakes have occurred: thus at Paris, at the Fontaine des Innocens, only two-thirds of the water calculated upon were obtained; whilst, in the faubourg St. Victor, only the half of that expected issued from the pipes. These differences appear to result from experiments made on too small a scale, or with apertures disproportionate to the areas of the tubes; for the results of practice come sufficiently near to the formulæ of MM. Prony and Eytelwein, when the velocity of motion in a pipe was small in consequence of a contracted aperture made in a plate of metal being used. When the contracting plate was altogether removed, then the product in water was a fourth or third less than that given by the formulæ, from which M. D'Aubuisson concludes that the resistance increases with the velocity in a greater ratio than that given to it in the calculations; where it is supposed to increase proportionably as $v^2 + m\,v$, m being nearly equal to 0.055, and v representing the mean velocity.

In consequence of the arrangement and state of the water-pipes at Toulouse, some large and accurate experiments have been made there by MM. Castel and D'Aubuisson, the systems of pipes of 4.7 inches and 10.63 inches in diameter, and 1434 and 1986 feet in length. In these experiments the quantity of water passed and the pressure were varied; the results were noted, and also calculated by the formulæ, so as to deduce the loss of pressure due to the resistance of the pipes: that by calculation came out 27., 25., 32.7, and 31.7 per cent. below the result of experiment. As the two latter were the principal experiments, it is concluded that, generally, calculation gives the resistance nearly one-third less than what is obtained by actual and careful practice.† [*Ibid.*

* Annales de Chimie, xliv. p. 103. † Ibid. xliii. p. 224.

To our Readers.

We place upon the last page of the Journal, a meteorological table, for the month of January.

The Institute have made arrangements by which a similar report will be secured to our readers monthly, and a committee has been appointed charged with this object.

Particulars in relation to the locality of the observations, to the instruments used, &c. will appear in our next number.

Committee on Publications.

Meteorological observations for January, 1831.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P.M	Barometer. Sun rise.	Barometer. 2, P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain and snow.	State of the weather, and Remarks.
				Inches	Inches.			Inches.	
	1	33°	36°	29.70	29.80	West.	Blustering.		Clear. Cloudy.
	2	28	38	30.10	30.20	do.	Moderate.		Clear. Clear.
	3	27	46	.20	.20	W. S.	do.		Clear. Cloudy.
	4	51	59	29.70	29.70	S. S. E.	do.	.90	Cloudy. Rain.
☾	5	57	42	.70	.70	S. W.	Lighter.	1.00	Rain. Rain.
	6	26	34	30.10	30.12	West.	do.		Clear. Clear.
	7	26	41	.10	.12	do.	do.		Clear. Clear.
	8	32	40	.13	.9	N. E.	do.		Cl'dy--cl'dy--hail at night.
	9	30	31	29.85	29.85	do.	do.	.65	Sleet. Snow.
	10	24	27	.73	.75	do.	do.	.50	Snow. Snow.
	11	23	32	.90	.85	do.	do.		Snow. Drizzle.
	12	26	26	.85	30.00	W. N. W.	do.		Clear. Clear.
⊗	13	8	16	30.03	.35	West.	do.		Clear—clear—very cold.
	14	20	20	.20	·10	N. E. S.	do.		Cl'dy-cl'dy--rain in night.
	15	20	23	29.33	29.30	N. E.	High.	.85	Snow—much drifted.
	16	18	24	.40	.40	West. E.	Blustering.	.45	Snow cont'd—18 in. deep.
	17	20	20	.40	.70	do.	Moderate.		Flying cl'ds—*nav. obstr'd.*
	18	8	24	.70	.60	do.	do.		Cl'dy—cl'dy—slight snow.
	19	21	32	.60	.53	do.	do.		Clear—good sleighing.
	20	23	39	.50	.50	S. W.	do.		Clear. Cloudy.
☽	21	14	20	.80	.80	S. E.	do.	.24	Clear—cloudy—snow 2 in.
	22	11	26	.40	.40	West.	Blustering.		Cl'dy-clear--fine sleighing.
	23	10	16	.60	.60	do.	do.		Clear day.
	24	7	20	.75	.75	do.	Calm.		Cloudy--clear--*Delaware*
	25	0	14	.70	70	do.	Moderate.		Clear day. [*frozen.*
	26	6	24	.70	.70	do.	do.		Do.
☺	27	14	26	.70	.73	do.	do.		Do.
	28	16	30	30.00	30.00	do.	do.		Do. Cloudy.
	29	24	34	29.90	29.80	do.	do.	.60	Cloudy—slight snow.
	30	18	26	.87	.90	do.	do.		Clear. Clear.
	31	12	32	.90	.83	W. South.	do.		Cloudy Cloudy.
				mdn't	.23			.90	Snow, hail, and rain in night.
	Mean	21 1	29 6	29.48	29.48			6.09	

	Thermometer.		Barometer.	
Maximum height during the month, . . .	59.	on the 4th, . . .	30.70	on the 2nd.
Minimum do.	0.	on the 25th, . . .	29.30	on the 15th.
Mean do.	25.3	. . . . . .	29.48	
Water fallen in snow and rain, 6.09 inches.				

JOURNAL

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FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

MARCH, 1831.

Report of the Committee of the Franklin Institute of Pennsylvania, appointed May, 1829, *to ascertain by experiment the value of Water as a Moving Power.*

The importance of accurate knowledge in relation to the effect of water as a moving power, and the defective state of information upon that subject, induced the Franklin Institute, in the spring of 1829, to determine that a series of experiments should be made, under its direction, upon the force of water applied by wheels; the experiments to be in detail, and upon a scale calculated to give confidence in the practical nature of their results. A call was to be made upon the members, and upon that portion of the public interested in the proposed researches, for aid, to enable the Institute to effect the object in view.

To obtain this aid, and execute the necessary experiments, a committee was appointed, consisting of members of the Institute. The number originally selected, was twelve; to these two members have since been added, the committee being now composed of fourteen members.

The appeal of the Institute to the liberality of its patrons, was readily answered, and the subscription lists of the committee soon contained an amount subscribed, sufficient to warrant them in preparing for the experimental part of their labours.

There is perhaps no subject connected with the extensive branch of mechanics, for which theory has done so little, as for that which

considers the effect of water upon wheels; the different theories* advanced are at variance with each other, and with practice, so that the candid theorist confesses that the circumstances, attending the action, are of so complicated a nature as to baffle his powers of investigation. Experiment, then, can alone guide to results worthy of confidence.

The experimental inquiries in relation to water-wheels which have, deservedly, attracted most attention, are those of Smeaton.† The means of a single individual could not be competent to prosecute such a subject upon the scale required to make the results entirely practical, and we find the ingenuity of Smeaton labouring against the difficulties incident to the contracted dimensions of the apparatus which he was obliged to employ, and arranging with great skill and resource the best means to render serviceable the working models which were used in his experiments.

The experiments of Bossut,‡ which rank next in extent to those of Smeaton, were comparatively few, and were principally made upon the undershot wheel.

It would not be profitable to enumerate the isolated experiments made in different countries upon this subject, since the sum of the information which they convey is extremely small. Of late years this branch of inquiry has been but little prosecuted, and the committee are not aware that any experiments, except a few in France,§ having in view a particular form of wheel, have been made, which tend to throw light upon the subject of their labours.

Such was the progress made in this subject when the Institute undertook it, with a view to obtain such results as should afford to the millwright a sure and safe guide in his practice, and thus contribute essentially to the promotion of one of the most important of the Mechanic Arts.

After frequent consultations of the committee, a plan of experiment was determined upon: the preparations of apparatus for executing this, occupied the autumn and part of the winter of 1829, and in the spring of 1830, the experiments were commenced. These occupied the committee until late in the following December, when the operations were finished for the season.

The committee consider that so little remains to be done to complete the proposed series of experiments, that they would not be justified in delaying their report, and that the results obtained should at once be placed before those to whose liberality the community are indebted for the opportunity of information upon this interesting subject.

It is hoped that means will not be withheld, by those who have

* Young's Analysis, or Gregory's Mechanics, vol. i. and 3d vol. American Philosophical Transactions.

† Smeaton's Experimental Inquiries, &c. (Taylor's Collection, 1794.)

‡ Détermination Générale de l'effet des roues mûes par le choc de l'eau, &c. 1769.

§ Poncelet, Mémoire sur la roue Hydraulique verticale à aubes courbes. Ann. de Chim. et Phys. (1825.)

not already contributed, to fill up the last subject upon the list of inquiries.

One of the most important questions which arose for the discussion of the committee, was the measure of power expended, and of effect produced, to be adopted in their investigations. They finally determined upon one which, while strictly correct in principle, was at the same time, from its simplicity and ease of application, well adapted to their purposes, viz. for the measure of the power applied, the weight of water expended multiplied by the height of the head, (kept invariable,) above the bottom of the wheel; and for that of the effect, the weight raised multiplied by the distance through which it was raised. In order that this measure of effect may be accurate, the friction and inertia of the machine must be considered. The friction was carefully ascertained by experiment and the proper allowance made for it, as will appear in the course of this report. Any resistance from inertia was avoided by causing the wheel, and of course the weight raised by it, to move, before beginning an experiment, with a velocity which would remain constant during its progress.

The committee were very favourably circumstanced in relation to the power to be applied in their experiments, having, by the vote of the city councils, at command, a head of water fully equal to that which it was deemed necessary to employ. The greatest head used in any experiment was twenty-three feet.

The building to contain the apparatus, was erected upon a site, put at the disposal of the committee by Messrs. Rush and Muhlenburgh, which was of sufficient extent to enable them to make, to the best advantage, the various arrangements required by the undertaking.

In order that the experiments may be more easily understood, the committee preface the detailed account of them, by a general description of the apparatus used, and of the methods of experimenting. This description is accompanied by three plates, of which plates I. and II. represent side views, and Plate III. gives an end view of the apparatus employed. The drawings refer to the arrangements made for experiment with the largest wheel used, that of twenty feet in diameter; alterations were made, from time to time, to adapt the apparatus to the use of the smaller wheels. The principal parts are designated by the capital letters, the subordinate parts by the small letters.* When any of the less important parts are shown much in detail in one of the plates, they are not always exhibited on the others. A scale to which the drawings were made is attached to the first plate.

The principal parts of the apparatus were, the forebay, or reservoir, for containing the water to turn the wheel, the frame supporting the wheel, the reservoir in which was collected and measured

* There are two kinds of small letters used, the *Italic* and the Roman, the small *Italic* letters are used until the whole number is exhausted, when recourse is had to the small Roman letters.

the water used, the wheel, and the means by which the weight raised and the space through which it was raised were measured.

These will be described in the order in which they have just been mentioned.

The Forebay.

The forebay, A, B, C, D, E, F, (Plates I. and II.) was constructed of timber frame work, consisting of upright posts secured at the bottom and top by being tenanted into cross-sills and caps: the cross-sills were raised about seven feet from the ground, being supported by vertical posts, (as shown in the drawing,) resting on timbers placed upon the ground. The frame, above described, was lined with planks, and was secured from yielding to the pressure of the water at points between the cross-sills and caps, by strong iron bolts which passed through each pair of posts, on the opposite sides of the forebay, and were placed at intervals increasing as the distance from the top of the forebay diminished. The planking on the back end of the forebay was supported at the middle of its breadth by an upright post, B, C, secured by bolts to the adjacent cross-sill and cap, and, at proper intervals between them, to cross timbers, H, H′, &c. (Plate I.) within the forebay, and supported by the planking of the sides. The floor of the forebay was laid upon the cross-sills into which the uprights of the frame work tenanted. The front end, A, F, (Plates I. and II.) projected beyond the centre of the wheel, and had, within, a breast, K, K′, K″, K‴, (Plate I.) made to fit accurately the periphery of the wheel, except near the top, (from K, to K′,) where an interval was left between the breast and wheel, to facilitate the discharge of air from the buckets. The breast was secured from springing, and made moveable at pleasure, to adapt it to the use of the smaller wheels, by accurately fitting the planks composing it to circular cleats, (not shown in the figures,) spiked to the forebay on the concave side of the breast; to press the planks against these cleats, a second set was spiked to the forebay on the convex side of the breast, between which and the breast-planks wedges of the proper form were tightly driven.

In the breast, apertures closed by gates were provided at different points, through which to let the water upon the wheel. The sluices, or chutes, connected with the apertures, were narrowest at the parts where the water issued, and delivered the water to the buckets nearly in the directions of tangents to the wheel at the several points of emission. The lowest, or undershot aperture, was not in the breast, but in a vertical partition, a, a', (Plate I.) extending from the floor of the forebay to the breast, the bottom of the aperture being on a level with the lowest point of the wheel; this aperture was closed by a gate sliding in vertical grooves, and the water flowing through it was delivered by a sluice, narrowing towards the point of emission, in a tangential direction to the lowest point of the wheel. The overshot gate at K, discharged the water immediately over the centre of the wheel. The details of drawing and description in relation to the construction of the gates and apertures, to the methods of gaug-

ing, &c. will be given when the committee treat of the action of the wheel under the several circumstances of experiment.

Water was admitted to the forebay through two iron pipes, L, L′, and M, M′, (Plates I. and II.) of 6 inches in diameter, passing through the bottom of the forebay, and connected with the pipes from the city water works: the supply was regulated by two stop cocks, at *b* and *b*′, (Plate I.) acted upon by levers of the second order, having their fulcra at *c*, and *c*′, which by the intervention of two vertical rods, *d*, *d*′, and *e*, *e*′, were connected with the levers, *d*′, *g*, and *e*′, *g*′; the common fulcrum of the levers, *d*′, *g*, and *e*′, *g*′, was at *f*, and their handles, *g* and *g*′, near the end of the forebay, were conveniently placed in relation to an assistant, on the upper floor, G, G′, whose duty it was to regulate the supply of water. The upper ends of the water pipes were made to project 18 inches above the floor of the forebay, that the rush of water from them might not produce irregularity in the action of the undershot aperture.

To show the level of the water within the forebay, a float, *h*, (Plate I.) moving freely in vertical guides, was placed at the back end: to this float a graduated tape line, *h*, *h*′, *h*″, was attached, passing over a pulley, *h*′, and kept tight by means of a weight, *h*″; an index, *i*, served to show upon the tape line the head of water sought. A valve, *k*, (Plate II.) in the bottom of the forebay, could be opened by depressing the end, *k*″, (Plates I. and II.) of the lever *k*′, *k*″, and served to allow the escape, when required, of the water, through the trunk, I, to the waste trough.

The levers for opening and closing the various gates in the breast were attached to the top of the forebay, in such positions as best to answer the ends to be accomplished by them. As the drawing would be much confused by an attempt to represent all these levers, but one system is shown, namely, that *l*, *l*′, *l*″, K, (Plate I.) for opening the overshot gate; the lever, *l*, *l*′, was oblique to the side of the forebay; by turning the handle, *l*, to the left, the fulcrum being at *m*, the end *l*′, and, (by means of the connecting rod, *l*′, *l*″,) the end *l*″, of the lever, *l*″, K, were turned to the right, which, the fulcrum of *l*″, K, being at *m*′, opened the gate at K.

Frame supporting the Wheel.

N, O, P, Q, represents the frame supporting the water-wheel: this frame was formed on one side of the wheel, (Plates II. and III.) by a double row of uprights, and on it the head block, *n*″, *n*‴, (Plate II.) was placed to sustain the plumber block, *o*′, on which one end of the axis of the wheel rested; on the other side, (Plates I. and III.) a single row of uprights braced from the floor, and connected at top and bottom, formed the frame; this was surmounted by the head block, *n*, *n*′, upon which rested the plumber block, *o*, carrying the axis of the wheel. This frame was disconnected from the forebay.

Reservoir for collecting and measuring the water used, Tail race, &c.

A reservoir, R, S, T, Q, (Plates I. II. and R, R, Q, Q, Plate III.) for collecting and measuring the water used in experiment, was made

by planking the interior of part of the frame just described; the sides and ends of the reservoir were carried to the height of six feet, and the floor was laid upon the cross-sills into which the uprights of the frame were tenanted.

This reservoir having been formed accurately into a rectangular prism, its capacity was calculated by measuring the length, breadth, and depth: to test the accuracy of the result, the reservoir was filled, up to a certain level, with water carefully weighed, the number of pounds which the whole reservoir would contain calculated, and found to differ but 20 lbs. in 30,000, from the weight obtained by means of the capacity.

To indicate the level of the water in this reservoir, with a view to determine the quantity used in any experiment, a hollow tin vessel, p, p', (Plate I.) was used as a float; a tube passed through the axis of the float, forming a stem, which was allowed to slide freely in a vertical direction upon an iron rod, or guide, attached to the bottom of the reservoir: the stem, q, q', of the float extended to a convenient height above the lower floor, N, O, and was graduated into divisions, each of which represented a quantity of water within the reservoir of 1000 lbs. in weight. A light bar of iron, r, r', was attached to the upper timber of the wheel frame, having at its upper end, r, a loop embracing the stem of the float; to this loop was affixed a sliding plate of brass, r, r'', the edge of which could readily be placed opposite to that mark, on the float rod, which might happen to be next above the loop; this mark then served as a point from which to estimate the quantity of water used in any experiment without, before commencing, actually emptying the reservoir. The number of divisions on the stem of the float which had passed the top of the slide during an experiment, showed within certain limits of accuracy, the quantity of water which had entered the reservoir; but for greater nicety of determination, a gauge plate minutely divided was applied to the top of the slide, by the use of which the quantity of water in the reservoir could be obtained to within 5 lbs.

The water after leaving the wheel was conducted through a slightly inclined tail-race, U, R, to the reservoir. To prevent agitation of the surface of the water, within the reservoir, which would have resulted from the fall of water introduced from the tail-way, a flume R, s, s', Q, (Plates I. II. and s, s, s', s', Plate III.) of a square section, was constructed, extending from the race nearly to the bottom of the reservoir, between which and the termination of the flume the water must necessarily pass; there was also a platform of light boards, nearly as large as the floor of the reservoir, placed within, which rose and fell with the surface of the water: these precautions so far preserved the float from oscillation, that the operator could obtain without delay by inspecting the gauge rod, the weight of water collected in the reservoir.

To empty the reservoir, a waste valve, t, (Plates II. and III.) was placed at one end; this valve could be opened by the lever, t', t''; (Plate II.) having its fulcrum at t''', acting upon the valve by the

intervention of the rods, t' t^{iv}, t^{v} t, (Plate III.) and lever t^{iv}, t^{v}; it was raised above the floor so that the reservoir might never be entirely emptied, and that thus a level would always be afforded from which to reckon the quantity of water which entered during any experiment.

As only the water used in experiment was to be admitted to the reservoir, a valve u, u', (Plates I. II. and III.) 15 inches in breadth, and in length equal to the breadth of the wheel, was placed in the floor of the tail-race; this valve when open, allowed the water from the wheel to fall into a trough u, u, v, v', v'', v''', (Plate III.) which conducted it on the outside of the reservoir, by the trunk w, w', (Plates II. and III.) to the waste trough. Guide boards were placed in the tail-way on each side of the valve, that all the water might pass through it when open. The closing and opening of this valve were effected by the action upon the stem x, x', (Plates I. and III.) of a series of levers, (Plates III. and II.) x', x'', y, y', y'', z, connected by vertical rods x'', y, and y', y'', and terminating in the stem z, z', on the side of the forebay shown in Plate I.; by means of a handle, z'', attached to this stem the operator on the first floor, N, O, O', was enabled to work the valve. When the valve was closed, the water flowed over it to the lower end of the tail-race, whence it passed, in the manner already described, to the reservoir. A bell, a, (Plate I.) attached by a spring to the stem z, z', ringing when the stem was moved, served to give notice of the closing or opening of the tail-way valve, that is of the beginning or end of an experiment. As in closing the valve, in commencing an experiment, the small quantity of water between it and the wheel, not used in the experiment, entered the reservoir, so on opening it, at the conclusion, an equivalent quantity of the water which had been used ran to waste.

The water carried up by the wheel when in motion, was returned to the tail-race by the guard, b, b', u', (Plates I. II. and III.) placed for this purpose, and conducted to the reservoir, or allowed to run to waste according to the position of the valve.

Water-Wheel.

V, W, U, X, (Plate I.) represents the water-wheel used during the first series of experiments; this wheel was 20 feet in diameter, and 20 inches in breadth, being 16 inches, in the clear, between the rims, or cants. The rims were attached to the arms in the usual manner. The axis of 12 inches in diameter, into which the arms entered, was surrounded, for a certain portion of its length, as shown in Plate III., by a barreling of 24 inches in diameter, the gudgeons, 3½ inches in diameter, turning upon brass bearings, fitted into cast iron plumber blocks; the whole rested on the head blocks n, n', n'', n''', (Plates I. and II.) capable of sliding upon the upper beam of the frame supporting the wheel, by which arrangement the wheel might be removed from the breast when alterations were required.

On the inside of the head block, at n, Plate I., an iron pin was fixed, connecting two straps, also of iron, in the manner of a joint hinge; these straps embracing the barreling of the shaft had their ends, d and d', connected by a wooden lever, d', d'', turning upon a ful-

crum, d‴, equi-distant from the ends which the lever connected; the pin forming the fulcrum passed through a post attached to one end of the head block: by depressing the end d″, of the lever, d′, d″, the straps were caused to press against the barrel with such force as to regulate, at the pleasure of the experimenter, the retrograde movement of the wheel produced by the descent of the weight which had been raised in any experiment; by elevating the same end of the lever, the straps were removed from contact with the barrel, which was thus permitted to revolve freely.

The buckets of the wheel having been varied in the different experiments will be described in detail in an after part of this report.

Apparatus relating to the Measure of Effect.

Y, Y′, Y″, and Z, Z′, Z″, (Plates I. and III.) represent two masts, or heavy posts, one of which was stepped upon the ends of two adjacent cross-sills of the forebay, at Y, the other, at Z, upon a strong piece of timber, bolted to the side of the frame, supporting the wheel. From the cap, Y″, Z″, (Plate III.) connecting these posts, were suspended two iron pedestals, e, e′, and f, f′, in which, in brass bearings, turned the gudgeons of a roller, or drum, e′, f′; the gudgeons were 1 inch and $\frac{7}{8}$ths in diameter. The drum, $16\frac{1}{2}$ inches in diameter, was covered with hoop iron, to prevent its abrasion by the chain which passed over it. The chain was attached at one end to the barreling of the shaft of the water wheel, and passing over the drum above, the other end, g, was fastened to a basket, g, g′, of iron in which were placed the various weights used in the experiments. To prevent inequality in the weight raised during any part of an experiment, from the winding of the chain upon the barrel, a similar chain, the lower part of which always rested on the ground, was fastened to the bottom of the basket.

The chain was kept from riding and chafing, as it wound upon the barrel, by depressing slightly the end f′, of the roller, thus giving the chain a tendency to move, in winding, towards the depressed end. The chain was brought back to its original position, at the higher end of the drum, during the descent of the basket, by inclining that part between the drum and barrel in an angle, to the axis of the drum, measured towards the elevated end, less than a right angle: to give this inclination a pulley, k, (Plates III. and I.) was fixed in an iron frame, k′, k″, capable of sliding in horizontal guide grooves; by drawing the frame towards l, the pulley was made to press against the chain effecting the object proposed. The iron frame, k′, k″, was drawn towards l, by a rope, one end of which was attached to the frame at k″, while the other passed over a fixed pulley, l, and was attached to an axle turned by the arms m, m′, and m, m″. The frame was carried back to the end, n, when the power ceased to be applied at the arms, m, m′, m, m″, by a weight n′, acting by the rope, n′, n, k′, passing over the pulley n, and attached to the frame at k′.

The measure of effect adopted was, as has been stated, the weight raised, and the height through which it was raised; to determine this

height a mark was fixed to the chain at a point convenient for beginning the experiments, and a second to serve as a point of termination. To enable the operator to judge accurately of the arrival of these points on a level with his eye, an indicator, p, p′, p″, (Plate I,) being a miniature crane, was attached to the side of the forebay frame, the horizontal arm being placed at the proper height above the lower floor O, O′; the habitual position of the indicator was, as shown in Plate I, with the horizontal bar resting against the forebay frame. Just before the arrival of the lower mark upon the chain, at the level of the indicator, it was turned at right angles to the side of the forebay; when the mark reached the indicator, the stem, *z*, *z′*, of the lever for manœuvring the gate in the tail race, was raised into the position represented in the figures, ringing the bell a; the ringing of this bell, and the closing of the tail-way valve, being simultaneous, the precise instant was thus marked at which the water began to be admitted to the reservoir. On the arrival of the second mark at the indicator, the stem, *z*, *z′*, was drawn down, by means of the handle *z″*, again ringing the bell, and marking the time of the conclusion of the experiment, namely, that at which the water was allowed to run to waste by opening the valve in the tail-race: the stem, *z*, *z′*, was kept in its new position, by inserting the baton q, beneath the lower edge of the rest, q′, q″.

A very accurate time-piece, with the dial graduated to half seconds, completed the apparatus.

Method of Conducting the Experiments.

A general statement of the methods of experimenting will now be given.

One person was stationed upon the upper platform, specially charged with regulating the head of water in the forebay: this he did by means of the levers *d′*, *g*, and *e′*, *g′*, (Plate I,) controlling the stop cocks, *b*, and *b′*, in the supply pipes, or when the level was too high, by letting off as much water as was required to reduce it, through the waste valve *k*, Plate II; the head was ascertained by the float *h*, (Plate I,) tape line, *h*, *h′*, *h″*, and index, *i*, already described. The same person being always employed in this duty was, by practice, enabled to preserve a required head, subject to a variation of not more than a quarter of an inch, during any one experiment. The same operator opened and closed the gates for letting the water upon the wheel, and regulated the position of the chain during the descent of the basket so as to bring it back to the elevated end of the roller, by turning the arms m, m′ and m, m″, connected by the rope l′, l, k″, with the slide, k′, k″, carrying the pulley, k, (Plate III.)

A second assistant was placed upon the lower platform, N, O, O′, (Plate I,) who had in charge the regulation of the break or friction strap, and the closing or opening of the tail-race valve, *u*, *u′*, for collecting, or suffering to run to waste, the water used by the wheel; he also placed the proper weights in the basket, allowed the escape of the water from the reservoir when necessary, &c.

A third person attended to note the circumstances of each experiment, to observe the time occupied, the quantity of water in the reservoir as shown by the gauge rod, and to make the necessary calculations.

When an experiment was to be made, the moveable plate *r*, *r′*, (Plate I,) of the reservoir gauge was set to the mark on the gauge rod next above the loop. One of the gates for letting the water upon the wheel, was then opened, and the wheel suffered to revolve, with a full supply of water, until the basket was raised sixteen feet; by this time all the moving matter had acquired an equable motion, and the first mark upon the chain coincided with the indicator, p, p′; at this instant the second operator closed the tail-race valve, in doing which he rang the bell, a, the signal for the third operator to note the time. The first operator now carefully kept the water in the forebay, at a constant level. The water used by the wheel passed into the reservoir, R, S, T, Q, until the second mark on the chain, coincided with the indicator, when the second operator opened the tail-way valve, at the same time causing the bell, a, to ring, thus giving notice to the third operator to mark the time, and to the first to close the aperture admitting water to the wheel, and to stop the influx of water into the forebay. The chain was then drawn back, by the pulley and slide described, as the weight descended retarded by the friction strap. By the time the weight had arrived at the lower platform, the surface of the water within the reservoir was at rest, the amount there collected was ascertained, and a memorandum of it placed upon the minutes.

[TO BE CONTINUED.]

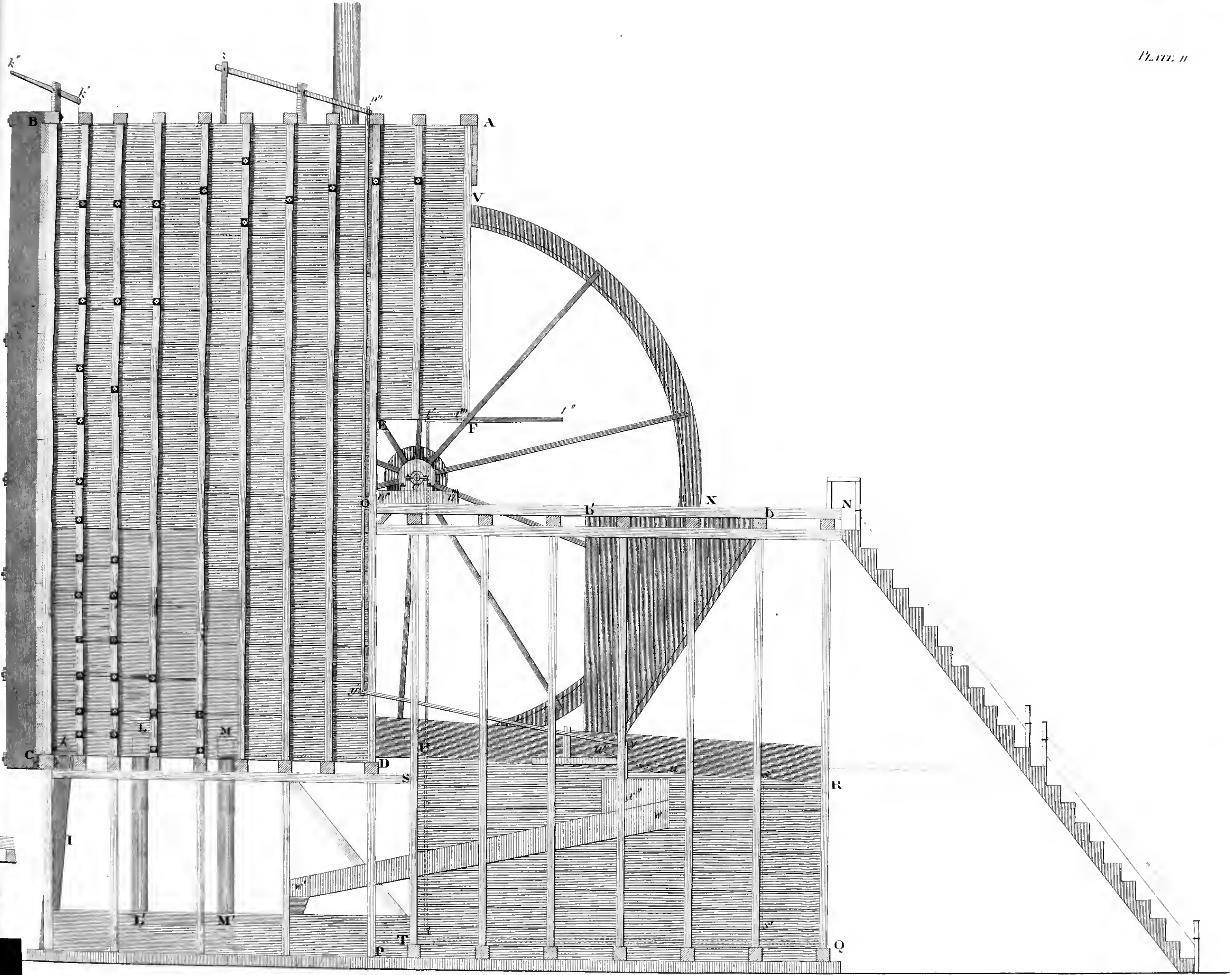
On the Causes of some Explosions of Steam Boilers. By THOMAS EARLE. *Read before the Franklin Institute, February* 24, 1831.

THERE have been several instances of explosions of steam engines, upon pumping additional water into the boilers, although the steam, before the addition of the water, had not shown a high expansive power. It is generally agreed, that immediately before these occurrences, the water has been very low in the boiler, the iron of the flue laid bare, and become very hot, and the steam also probably heated to an unusually high degree. But a doubt has arisen whether the heat that produces the great excess of steam, which causes the explosion, is borrowed from the hot iron, or from the hot steam previously in the boiler. The object of this paper is to endeavour to do something towards settling this question.

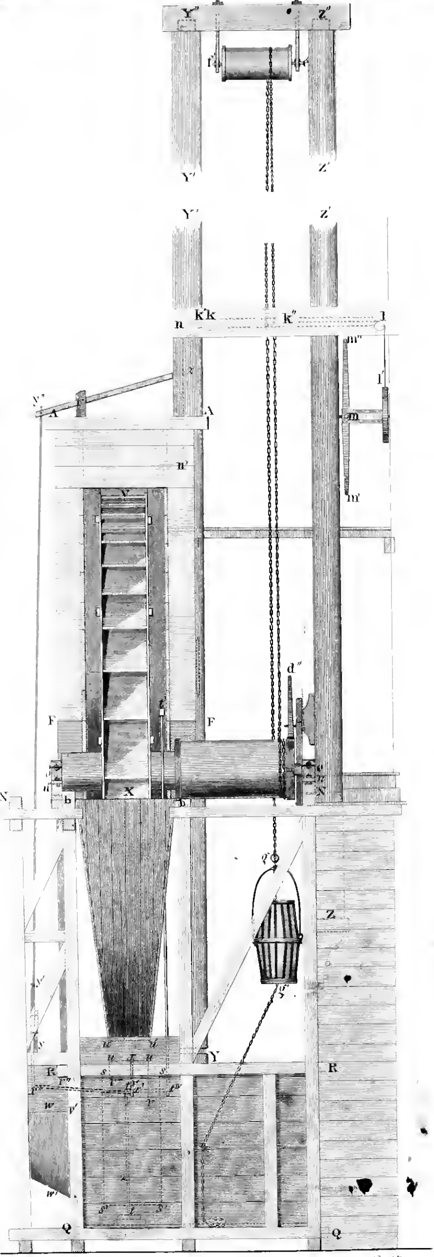
Question 1. If heat be borrowed from steam at a high temperature, to convert additional water into steam at a lower temperature, will the whole quantity of steam thus obtained possess more elastic force under a given volume, than belonged to the hot steam alone?

It is an ascertained law of steam and of all gases, that equal additions of temperature, give nearly equal additions of volume. It is also ascertained that gases and steam for each degree of heat they re-

Plate II



... ascertained that gases and steam for each degree of heat they re



Engraved by J. Yeager

ceive, gain about $\frac{1}{480}$ of the volume they occupied at 32° Fahrenheit. This would give a gain of $\frac{1}{660}$ of the volume occupied at 212°, for each additional degree of heat above that point. Hence, an addition of 660 degrees of heat, should increase one volume of steam, at 212, to two volumes, under the same pressure, or should double its power.

Then if we have water at 212, and to 1 gallon, add 960 degrees of heat, we get about 1700 gallons of steam, under atmospheric pressure: then put 960 degrees more of heat and another gallon of water, we increase the steam to 3400 gallons: whereas if, in the last case, we had added the heat to the steam already made, 663 degrees would have sufficed to increase the steam to 3400 gallons. Thus $960 + 960 = 1920$ degrees of heat, in the first case produced no more effect, than $960 + 663 = 1623$ degrees do in the latter Heat added to steam *already formed*, is, therefore, more effective than the same quantity of heat added to hot water: and the theory of explosions from water converted into steam, by heat borrowed from other steam, cannot be true, unless the specific heat of steam be much greater than that of water, under equal weights; or, in other words, unless it takes a much greater absolute quantity of caloric to raise a pound of steam one degree, than it does to raise a pound of water one degree.

Dr. Crawford, from his experiments, inferred that the specific heat of steam was 50 per cent. greater than that of water. If this were correct, the effect of a certain quantity of caloric added to steam, or added to hot water, would be just about equal. But the more recent, and generally believed more correct experiments, of Delaroche and Berard, give a greater specific heat to water than to steam, in the proportion of 1,000 to 0,847. From this it would result, that heat added to steam, produces nearly double the effect which it would have done, if employed to generate more steam. On the whole, assuming as correct either Mr. Crawford's conclusions, or those of Delaroche and Berard, explosions cannot be produced by pumping even water at 212 degrees into highly heated steam, without the aid of some other cause.

Question 2. Can explosions be produced by pumping water on red hot iron?

The specific gravity of iron compared with water is as 7.788 to 1,000, say as 8 to 1; and the specific heat of hot iron compared with water under equal weights is as 0.1255 to 1: say as 1 to 8.* It takes about 8 times as much caloric, to heat a pound of water one degree, as to heat a pound of iron one degree: but about equal quantites to heat a given *measure*, say one cubic inch, of each substance. Consequently a cubic inch of iron at 300 degrees, on being reduced to 250 degrees, parts with nearly 1700 times as much heat, as a cubic inch of steam at 300, reduced to the same degree: and a cubic inch of

* Some experiments tend to show the specific heat of iron, compared with that of an equal weight of water, to be as 1 to 9. The difference, however, is entirely immaterial to the purposes of this essay.

red hot iron at 1172 degrees, has heat enough to convert one cubic inch of water into 1700 cubic inches of steam.

Hence it appears extremely easy to produce explosions from throwing water on hot iron, as indeed is proved by Perkins' steam gun. If that gentleman's generators had been no stronger than ordinary boilers, they would have been destroyed by one-third of the power which he produced by throwing water on their red hot iron: and strong even as they were, they would have exploded had he pumped in a sufficient quantity of water, without giving vent to the steam produced.

A cubic foot of hot iron by being reduced to 32 degrees, would furnish heat sufficient to convert a cubic foot of ice cold water into 13,600 gallons of steam, at atmospheric pressure: and a single square foot of boiler-iron, $\frac{5}{16}$ of an inch thick, if only at a bright red heat, has caloric enough to make 88 gallons of steam. It is probably not very uncommon for boilers to become so destitute of water, that 10 or 15 square feet become red hot. This surface, by losing only half its heat, would produce steam enough in addition to that already existing, to explode almost any boiler.

The sudden cooling of a part of the boiler, no doubt weakens it very much, and hence we find some boilers in their rupture following the water line, which line was probably made by a fresh supply of water, or by a motion of the steam boat raising the water upon the heated iron of one side.

The explosions which have occurred about the period of coming to, or leaving a wharf, may be attributed to the boat's being thrown partly on one side, either in turning, in striking the wharf, or under the weight of passengers shifting their position, so that the water is thrown upon hot iron of the boiler.

The conclusion to which I come, is, that a considerable proportion of the explosions which occur, is occasioned by water being thrown on highly heated iron. The proper preventives, are, care in engineers, and such construction of boilers, that the part exposed to the greatest heat will not be soonest laid bare, nor a large surface either suddenly laid bare, or suddenly covered by water: also to throw the water into the bottom of the boiler, rather than by a jet into the upper part.

FRANKLIN INSTITUTE.

Monthly Meeting.

THE stated monthly meeting of the Institute was held at their Hall on Thursday evening, February 24, 1831.

THOMAS FLETCHER, vice president, in the chair.

The minutes of the last meeting were read and approved.

The following donations were presented to the Institute, viz.

By Mr. A. B. Hutton.

The Mechanics' Journal, or Artisans' Miscellany of Inventions, Experiments, Projects, and Improvements in the useful Arts.

By Mr. Zachariah Allen.

The Science of Mechanics as applied to the present improvements in the useful Arts in Europe and in the United States.

By Mr. Josiah Copley.

Letter from the Secretary of the Treasury, transmitting the information required by the House of Representatives in relation to the growth and manufacture of Silk, adapted to the different parts of the Union.

By the Board of Managers of the Institute, for 1830.

Précis, Elêmentaire de Physique Expérementale, par J. Biot, Vols. 1 *and* 2.

By Professor A. D. Bache.

Catalogue of the Officers and Students of the University of Pennsylvania, January, 1831.

The corresponding secretary laid on the table the following works, received in exchange for the Journal of the Institute, viz.

The Mechanics' Magazine, and Journal of Public Internal Improvements, for January, 2 *copies.*

Journal of the Philadelphia College of Pharmacy, for January.

American Annals of Education and Instruction, and Journal of Literary Institutions, for February.

The Magazine of Useful and Entertaining Knowledge, for January.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale, for August, 1830.

Professor A. D. Bache stated, on the part of the committee on explosions of steam boilers, that the preparatory arrangements for experiments had been made, and apparatus for further prosecuting the objects of their appointment was in progress.

Professor Johnson from the same committee stated, that the committee had taken measures to obtain specimens of American iron for the purpose of experimenting on the strength of the different kinds of that material employed in the formation of steam boilers.

Mr. D. H. Mason made some remarks on the application of the power of steam engines to locomotive carriages.

Thomas Earle, Esq. read a paper "on the causes of some Explosions of Steam Boilers," which, after some remarks, was referred to the committee on publications.

The following queries were proposed for discussion, and ordered to be entered on the minutes.

1st. The subject of rapid and slow motions of boats in abrading the banks of a canal.

2nd. What are the relative advantages of stationary and locomotive power, in propelling carriages on planes of any elevation?

3d. What are the best means of securing the boilers, cylinders, and all other parts of steam engines, whether employed for stationary purposes, for navigation, or for locomotive carriages, against loss of power by radiation and conduction?

Thomas Fletcher, *Vice President.*

J. H. Bulkley, *Recording Secretary.*

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN NOVEMBER, 1830.

With Remarks and Exemplifications, by the Editor.

(Concluded from page 84.)

14. For machinery for *Planting and Digging Potatoes,* and for ploughing corn, potatoes and other plants; Phineas Meigs, and Matthew C. Arnold, Madison, New Haven county, Connecticut, November 3.

The machine which serves as the foundation of the different operations, is framed together much in the manner of a common plough. There are various distinct parts, which are capable of being attached or removed at pleasure. Thus a double or single mould board may be used. A kind of harrow, may be attached to the beam behind the mould board, to collect the potatoes; and several other contrivances are represented in the drawing, some of which, we doubt not, may be advantageously employed. The whole is clearly explained, and distinctly represented in the drawings. The claim is to the construction of the machine as described, which is capable, by changing its parts, of performing the different purposes specified; the mode of combining and fastening the different parts; and the application of steel plates, and nose pieces, which may be renewed at pleasure.

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15. For *Combined Spiral Springs, for Clocks;* Silas B. Terry, Plymouth, Litchfield county, Connecticut, November 3.

The object of this invention is to combine several spiral springs together, in such a way, that a clock when wound shall run three or four times as long as with a single spring.

The patentee says, "instead of a single spiral spring, such as is commonly used for spring clocks, or time pieces, I employ two, three, four, or more, such springs, but made narrower than those which are usually employed; so that two, three, or more, need not collectively be wider than the common clock spring.

"I sometimes enclose each spring in a barrel, resembling the barrel usually employed, but only of sufficient depth to receive the spring. Such barrels and springs may be connected with each other, and made to act in combination.

"Instead of forming a barrel, I sometimes use a circular plate, having near its periphery a number of projecting pins. These projecting pins answer the purposes of the rim in the barrel, as they retain the spring in its place, and one of them serves to fasten its outer end, by merely giving it a turn, that it may slip over one of the pins. A circular piece is fastened on the opposite side of this plate, to receive the inner end of a spring.

"Upon this plan, such a number of springs may be added as shall

give the desired number of turns, and a wheel and pinion be saved in the construction of a time piece.

"From the great length of spring afforded by this combination, a uniformity of action is secured, which will cause a time piece to which it is applied, to act with greater regularity without a fusee, than is possible with the ordinary spring; whilst from its great flexibility, the spring is less liable to break, or to fail in any way.

"What I claim as my invention, and for which I ask a patent, is the combining, or connecting together, a number of spiral springs, upon the principle, and for the purposes herein before described."

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16. For a machine for *Washing Gold;* Daniel Jones, Granville county, North Carolina, November 3.

The mode of agitating the earth to be washed, and of supplying a stream of water to effect the object, is very similar to methods which we have before described; the patentee does not tell us in what his invention consists, or make any claim to any part of the machinery.

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17. For a *Machine for Scraping the Flesh and Hair from Hides and Skins, and Dressing the same;* Thomas Williams, Rochester, Monroe county, New York, November 4.

(See specification.)

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18. For an *Inking Apparatus*, being an improvement on the inking apparatus of 'Neal's Vertical Printing Press,' and applying the same to other presses; Rich Wood, City of New York, November 4.

(See specification.)

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19. For an improvement in the *Cotton Press;* Joseph Carson, Raleigh, North Carolina, November 4.

The press here described is a rack and pinion press, so arranged as to be conveniently employed in the pressing of cotton.

The shaft of the pinion is vertical, and a braced beam extends horizontally from it, to move it by horse or other power. The lever must be of such length, as to enable the horse to walk clear of the frame work of the press. A stout piece of timber, provided with teeth, form the rack, and forces up the follower against the cotton. The mode of framing, and the appurtenances for forming the bales with convenience, do not differ from those previously used in other cotton presses.

The whole machinery is described, but no claim made. We are not aware, that, in the present instance, the omission is of any importance.

20. For a *Washing Machine;* Gideon Lowell, Nunda, Alleghany county, New York, November 6.

This, like numerous other washing machines, has a cylinder, the periphery of which consists of circular rollers; the gudgeons of this cylinder rest upon the edges of a trough. The article to be washed is placed between the cylinder, and circular rollers crossing the trough. Springs are used to regulate the pressure. The cylinder is to receive a vibratory motion.

The patentee tells us, that "the improvement claimed *on* the above described machine is the whole, except the box or sink, and that made 2 inches wider, which is a great advantage in washing large clothes." We do not know whether or not it is intended to claim the two inches; perhaps, however, it will be best to do so, as they will distinguish this machine from others, as clearly as its other novelties.

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21. For a *Machine for Thrashing Grain and Clover Seed;* James Darrah, Corkstown, and Jacob Kinsey, Ruscomb-manor, Bucks county, Pennsylvania, November 6.

The cylindrical beaters are in the common form, fluted upon their edges. The hollow segment consists of rollers of cast or wrought iron, turning on pivots, and the bars twisted in reversed directions. A simple fluted bed is to be used for clover seed.

"The *Invention* here claimed, is the double frame, to enable the cylinder to run in three boxes." That is, the shaft of the cylinder has three bearings, one on each side of the wheel by which it is to be turned, and one at the opposite end. "The bead in the boxes with the corresponding groove in the spindle." The common plan of a fillet on one of the boxes, and a groove in the spindle, operating like the swell on a grindstone spindle, is here intended; for although not mentioned in the description, this fillet appears in the drawing.

"The screw rollers and side plates, with the bolts and spiral springs. The additional roller in the feeding apparatus, and the fluted bed to be used for clover seed."

It is one of the most difficult points in a specification, even where a machine possesses much of novelty, to "distinguish the same from all other things heretofore known or used." This difficulty must necessarily increase with the want of originality in a machine, but even in such a case it may be as well to say little or nothing about it, and it certainly would be prudent to avoid claiming as new, what every tyro in mechanics knows to be far older than himself.

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22. For a mode of *Uniting Timber in Building Domes, Bridges, &c.;* William Annesley, Albany, New York, Nov. 6.

(See specification.)

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23. For improvements in the *Mode of Building Vessels;* William Annesley, Albany, New York, November 6.

(See specification.)

25. For an improved labour-saving *Tanning Apparatus;* William Brown, City of New York, November 11.

(See specification.)

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26. For an improvement in the *Power Loom;* John Standish, Belfont, Providence county, Rhode Island, November 11.

"My improvement in weaving consists in pressing the cloth beam against the yarn beam, by levers, as is clearly explained in the drawing annexed, fully complying with the requisitions of the patent act. The advantage resulting from my improvement, is in consequence of the two beams revolving with equal motion. As the yarn is discharged from the yarn beam, the cloth is wound upon the cloth beam with an equal, steady motion; avoiding the inequalities in the cloth as woven in the usual method."

The foregoing sententious paragraph, comprehends nearly the whole of the specification. In it is contained the description of the machine, an account of its utility, and a decision that the patent law has been fully complied with. We hope for the sake of the patentee, that the plan may be found to be new, useful, and profitable.

The arrangement is well represented in the drawing. The gudgeons of the cloth beam run in moveable uprights, connected together by a bar, and are operated upon by a weighted lever. No machinist would be at a loss in carrying the plan into operation, the simple idea being once given.

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27. For an improvement in the *Temple of the Common Power Loom;* John Standish, Belfont, Providence county, Rhode Island, November 11.

The specification of the temple is about as short as that of the power loom; it refers, however, throughout, to the drawings which accompany it; these are so wretchedly executed, that we could not undertake the task of deciphering them.

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28. For improved *Fire Engines;* John James Giraud, Baltimore, Maryland, November 11.

We have more than once met with Mr. Giraud, in our visits among the patentees, and we recollect that his anticipations are always of an elevated character. In the case in hand he has taken care not to fall below his ordinary level. In his peroration the patentee informs us that by his "improvements in hydraulics and fire engines, water may be thrown double the distance as is accomplished at present, and with very little power."

The description then informs us that two cylinders, each with caps or domes, are to be placed one within the other, a space of an inch being left between each; but as one of the cylinders is to be six, and the other five inches in diameter, we should have looked for only half an inch of space between the two. The inner cylinder is to be suspended within the outer, and its lower edge is not to reach to

the bottom, as it is to operate as an air chamber. The lower end of the outer cylinder is to be closed by soldering a bottom on to it. The particular form of some of the parts cannot be given without a drawing, and this we do not think the occasion justifies. The part which we have described operates simply as the common air vessel. Two openings are to be left in the bottom of this vessel, which are to be covered with valves. Two forcing pumps constructed in the manner of those used in other fire engines are to force the water into the air vessel. A pipe to receive the goose neck, passes through the domes or caps, of the two first described cylinders.

We now quote the patentee.

"Upon the same principle may be constructed a great reservoir for atmospheric air, and to raise water of itself to a certain height, by pressing this air by means of a pump of a suitable construction, with weights attached to the piston to produce a pressure calculated to raise the water to a given elevation.

"I claim my principle as here described, not only to convey water, but also with the same mechanical means, fire and steam, fluids of every description, gases, &c. single or compounded. I also claim my principle applied in any manner whatsoever, to machinery of every and all descriptions. J. J. Giraud."

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29. For an instrument for *Stemming of Dry Tobacco;* Germain Bréant, City of Richmond, Virginia, November 11.

A strip of steel about eight inches long is fixed upright upon a table. Through this strip there are three holes of different sizes; the stem is to be drawn through one of these holes, when its sharp edge will strip the leaf from the stem. The strips, the patentee says, are much more perfect than those obtained by hand. The quantity of leaf is greater, and a new hand can perform the work with the same facility as an adept.

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30. For a *Rotary Straw Cutter;* Samuel Wilson, Darlington District, South Carolina, November 11.

A solid wheel is made to turn by a crank, in the manner of a grind stone. On the flat face of the wheel, on the side opposite to the crank, is fixed three, or any other number of cutters, in the direction of radii of the wheel; these steel cutters stand out from the face of the wheel, at a distance equal to the length of the intended cut straw. The straw is placed in a trough, and is to be fed to the cutters by hand or otherwise. The claim is as follows.

"What I claim as new in this invention, is the arrangement of the cutters on the face of the solid wheel, in the direction of the radii of the wheel, and at a distance from the face of the wheel, equal to the required length of the cut straw. I further claim as new, the iron, or steel fixture on the reversed face of the wheel, nearly opposite each other, and rubbing against the iron fixture in the frame, which prevents the wheel and the cutters springing from the fixed plate, which forms a part of the shear, or cutter."

Where the straw is fed by hand, the solid wheel offers some advantage, but where it is fed by rollers, as in numerous straw cutters, it affords none. The cutters forming radii to the wheel, is far from being an improvement upon those which are curved, or which form an angle with the radii. The general structure of this machine seems to us to possess no just claim to novelty.

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31. For an improvement in the manner of *Covering the Roofs of Houses with Plates of Tin*, Copper or Zinc; Peter N. Ware, Albemarle county, Virginia, November 11.

"The said improvement consists in locking, or grooving the sheets together at the bottom, as well as on the sides, and securing each sheet as it is put on, with hooks of the same metal, at top, and on the side; the hooks being nailed on to the sheeting plank. The advantages are evident, as not a single nail passes through any one sheet of the entire roof, except on the outer edges. The locking at bottom prevents the draft of air which causes leaks."

The foregoing is the whole of the specification. The patentee is mistaken in supposing, that the grooving of the sides and bottoms of such plates, is a new invention.

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32. For a *Self Tightening Sacking Bottom Cot Bedstead;* Peregrine Williamson, City of New York, November 11.

There seems to be a little too much complexity about this self tightening cot. A description of it would not be very intelligible without a drawing; and we pass over many things to which we would more willingly afford one. If the invention possesses a moiety of the virtues ascribed to it, it is a very good thing. The claims are not few in number, and, we think, not all original; among them are, the application of a mortise in the legs, which mortices are slots, allowing the pin of the stretcher, which extends from one pair of legs to the others, to slide in them; the application of rails inserted into the head and foot boards, so as to revolve on their axes; the application of wheels to the feet; the supporting bar, with the piston rod attached; the application of a stretcher to the centre of the legs; the lever fastening; the application of slots, and also detachable woven cord bottoms to cots, &c. &c.

We have frequently seen stretchers to the legs, and detachable bottoms, attached to the rails by pins, as shown in the drawing. If there is any thing new in the mode of applying them by the present patentee, we do not understand his description.

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33. For an *Apparatus for Holding Tow Lines,* and for other purposes; Robert Davis, Philadelphia, Pennsylvania, Nov. 11.

This apparatus is a kind of double lever, working upon a pin something like a pair of shears, a spring operates to close the ends which are to hold the tow line; these ends have a cavity through

which the line passes. When, to prevent accident, it becomes necessary to detach the tow line, the upper lever is to be pressed down, and the line liberated. The apparatus appears to be simple, but it is not clearly described.

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34. For an improvement in *Cider Mills;* Charles Rice, Barre, Worcester county, Massachusetts, November 11.

This cider mill and press are placed upon wheels, to move them from place to place. There is a sweep, attached to an upright shaft, to be turned by horse power. The apples are put into a hopper, at the lower part of which is a cylinder with teeth, by the revolution of which they are ground. The pommage falls into a square or circular rack, or cage, in which it is to be pressed. At the bottom of this cage there is a follower, which may be drawn up by two screws, the cider then runs down into a trough below.

"The *invention here claimed*, and for which a patent is desired, is the press; the rack; and the arrangement of the different parts of the mill as before described."

This claim we think much too indefinite, as there are other patented cider mills in which some of the arrangements are essentially the same with the present.

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35. For an improved *Cloth Mangle;* Thomas Rundle, Boston, Massachusetts, November 11.

In this machine, the mangling is to be performed between cylinders, without a traversing box. The method of making the whole is illustrated by drawings, referred to throughout. The admeasurement of the different parts is given with minuteness, but we are not told in what the novelty of the machine consists, nothing appearing in the form of a claim. The use of rollers, pressed together, instead of a loaded box, is certainly not new, yet according to the tenor of the specification, the whole machine must be considered as claimed.

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36. For an improvement in the *Lathe* for shaping various articles of irregular form, according to a pattern; Elias Rhodes, Kingsbury, Washington county, New York, November 11.

The specification commences by informing us that the "species of lathe to which this improvement is applicable, has been in use for a number of years past, for the shaping of gun stocks, and other articles of irregular figure according to a pattern of the article to be formed. The general principle of its operation is well understood, and will therefore require but a brief description."

After giving this brief description, it is said,

"What I claim is the application of one or more circular saws to the above described lathe, for the purpose of shaping axe helves, wagon spokes, or any other article which may be shaped therein, excepting lasts and hat blocks."

This is rather a curious kind of claim, and one which is based

upon a common, but very mistaken notion. The patentee does not pretend to have invented the machine, and excepts lasts and hat blocks from his claim, because they are made in a similar lathe. It has been decided in court, and the decision rests upon the plain dictates of common sense, that to apply an old machine to a new purpose, is not an invention, or discovery, for which a patent can be sustained.

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37. For an improvement in *Spinning Cotton Yarn, &c.* being improvements in his running cap spinner, &c.; John Thorp, Providence, Rhode Island, November 11.

The specification of this patent was published in our last volume, page 288.

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38. For an improvement in the machine for *Thrashing Grain and Hulling Clover Seed;* Leuman Cooley, City of Philadelphia, November 11.

This thrashing machine differs not, in its general structure, from the great family of that name. The beaters are not to run in a straight line from one end of the cylinder to the other, but are to be bent in curves, or to form angles, that they may strike the grain obliquely. The claim is to "the angular, or curved beaters, they having a tendency to spread the grain equally over the cylinder, before coming in contact with the concave bed, and also preventing the whole length of the beater from striking the grain at the same time, and causing less friction."

"Placing of the concave half circle, or bed, round the end of the machine, which admits a much greater concave than can be obtained in any other way; consequently the cylinder may be placed at a greater distance from the concave bed, thereby admitting a larger quantity of grain, as the cylinder has a more extended space to act upon it. It also separates at the same time the grain from the straw."

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39. For a *Combined Plough;* Samuel Cline, New Britain, Bucks county, Pennsylvania, November 12.

This combined plough is intended for ploughing in light, free soils. There is a beam with handles attached in the usual manner; the ploughs, however, are not fixed to this, but to a second beam which crosses it at an angle of 45 degrees. To the transverse beam it is proposed to affix five ploughs; the centre one standing at the point where the transverse is attached to the ordinary, or longitudinal beam. This may be called the centre plough. The transverse beam is about 5 feet in length, the ploughs placed about 14 inches apart, causing them to cut about ten inches each. The ploughs consist simply of a mould board, landside, and sheath, or standard. The mould board is drawn and flattened out so as to supply the place of a share. The sole of the plough is not much to exceed its

extreme breadth. Ten inches in length, and eight in breadth, it is said, has been found to answer perfectly well.

"Two horses are able to work this combined plough quite easily, and to pass over as much land in a day as three teams of two horses with the common single plough." So avers the patentee.

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40. For an improved *Fire Proof Chest;* John Scott, City of Philadelphia, November 12.

The patentee claims to have made various improvements in the fire proof chest, and in doing so we are more than apprehensive, that he has included things which are without the shadow of novelty. We give the first as an example.

"Sec. 1. I improve the incombustibility of the wood used, by steeping it in a composition of water with salt, and pot and pearl ashes; the precise proportion of each not being material. The use of the pot and pearl ashes in this way, and for this purpose, instead of common wood ashes, constitutes this portion of my improvement."

Now there is just as much difference between the ley from common wood ashes, and a solution of pot and pearl ashes, as there is between brine and salt and water, potashes consisting entirely of the saline matter which is left after evaporating the water from common ley. There is no novelty in this application.

The second improvement consists in covering the wood with a coat of glue and emery.

The third in making drawers of tin, instead of wood.

The fourth is in the form of the castor, which consists in making some parts of it rounding which have *sometimes* been made flat.

There are in the whole ten sections, each referring to a particular improvement, so called, and some of them probably deserving the name; but in taking out a patent, if a new piece is put upon an old garment, the rent is made worse, by at least thirty dollars.

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41. For a mode or manner of *Supplying the Boilers of Steam Engines with water;* John S. Williams, Maysville, Mason county, Kentucky, November 17.

(See specification.)

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42. For an improvement in *Monuments, Memento Plates, Statues, and Mantel Pieces,* by the application of cast iron instead of stone or wood; Henry Libeneau, City of New York, November 17.

This patent is taken for making the foregoing articles of cast iron. In the specification we meet with calculations of the relative cost of cast iron and stone, and have an essay upon the subject rather than a description of what the patentee has invented. There is no claim made, and the whole, therefore, is patented. We have no confidence in the validity of such a patent; or rather we feel confident

that it is altogether invalid. Cast iron mantels, and, indeed, articles of almost every description to which this material is applicable, are made in England, and have been in use for many years.

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43. For a machine for *Raising Mud, Sand, or Gravel, from the Beds of Streams, Rivers, and Harbours;* Elisha H. Holmes, Norwich, New London county, Connecticut, November 18.

The general structure of this machine is similar to some of those now in use for the same purpose. The patentee says, "some of the advantages gained by my improvements, are the facility and despatch with which the machine is operated. Heretofore the shovel has been brought back by hand, by a crank on the stern of the boat, whereas it is now brought back by the horses, or whatever other power may be applied."

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44. For a method of *Ornamenting Horn and Tortoise Shell Combs,* so as to resemble carved work; Maulby J. Littleboy, City of Philadelphia, November 19.

This patent is obtained for pressing tortoise shell and horn combs in dies, by the aid of heat. Combs so ornamented have been imported in great numbers from India. This mode of ornamenting articles made of these materials is one of the best known processes in the mechanic arts; still the patentee claims "the method of putting an ornament, or impression, upon horn and tortoise shell combs, so as to resemble carved work, by dies, heat, and pressure."

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45. For a *Kitchen Grate;* Levi Disbrow, City of New York, November 22.

This, which the inventor calls the Jackson Grate, is for burning anthracite coal, and is made exactly like the grates most commonly used for that purpose, but of greater length. To regulate the size of the fire he uses partitions of iron which are moveable, and extend from the front to the back of the grate. We are told that there may be an oven attached, if required, and that the crane should be strong enough to bear what is hung on it, which is certainly very proper. "The patent is not claimed on the grate alone, but as to the manner of applying it to use." This is all that appears in the form of a claim, and as we do not clearly understand what is meant by it, we leave it to the judgment of our readers.

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46. For a machine for *Washing of Clothes,* scouring of yarn, &c.; J. Tenny, New Woodstock, Madison county, New York, November 23.

A swing frame with a roller at the bottom of it, is made to vibrate by hand; the clothes are placed in a trough with a bed piece of suitable curvature.

There is no claim, and as similar machines have been long since

patented, tried, and abandoned, we apprehend that the want of a claim will not be a source of loss.

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47. For a machine for *Hulling Clover Seed, Rice, &c.;* William Manning, Westfield, Essex county, New Jersey, Nov. 24.

The invention claimed is "the mode of hulling clover seed, rice, barley, and other small grain, by the revolution of a cylinder in a curved hollow bed, covered with wire, or other teeth."

We know of no method more commonly adopted than that of hulling by a cylinder set with teeth, and working in a concave bed, it is probable, therefore, that this machine, if well made, may, in one respect, fulfil the anticipations of the patentee; we were going to say of the inventor, but he, undoubtedly, has "passed the bourne."

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48. For an improvement in *Clocks and Time Pieces;* Jacob D. Custer, Norristown, Montgomery county, Pennsylvania, November 24.

The specification of this patent is by no means a description. A drawing accompanies it, but this is without written references. A model is referred to throughout, which model is in the patent office, and is incapable of publication.

This mode of procedure is altogether incorrect, and insufficient. The model is a mere contingency, and it is requisite that the invention should be made fully known without any reference to it.

What appears in the form of a claim we will copy, although it will afford but little light respecting the nature of the thing patented.

"The following are the parts improved, which your petitioner claims. The whole of the moving works except the weights and line. And the whole of the striking and alarm works except the barrel wheel and its line and weight. And the piece that comes out through the dial, at the left side, to set it to strike, or strike and alarm, or alarm only, or neither strike nor alarm. And the main wheel, and the date wheel, and the case. And the fly wheel and verge, or pendulum and verge, or scales and verge, to regulate the stroke. And the hammer with a spring as common clocks. And the bell on the top as in common clocks. And the time piece the same as the moving works of this model. And the application of those striking, or alarm works to watches. And the application of those striking or alarm, or moving works to clocks made in the common way, and wooden clocks made after this plan."

JACOB D. CUSTER.

The foregoing claimer, and disclaimer, is a fair sample of the clearness, or rather of the ambiguity, of five closely written pages of description. Those who do not understand the thing from the foregoing, are referred to the model room at the patent office.

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49. For a *Thrashing Machine;* Alonzo S. Smith, Brutus, Cayuga county, New York, November 24.

The usual cylinder with teeth, and a hollow segment form the

operative parts of this machine. There is a long list of claims for the particular mode of forming and arranging certain parts, but we do not see in it any thing particularly worthy of notice.

50. For an improvement in the *Machine for Dressing Hemp and Flax;* Joel Dewey, jr. Troy, Rensellaer county, New York, November 25.

This machine is much less complex than most of those used for flax dressing; and this would be no small praise, provided it was equal to them in operation. It appears to us, however, to be an improvement somewhat like those which have been proposed in the steam engine, by individuals unacquainted with its history, who have gone a hundred years back, and patented Capt. Savary's over again.

The patentee uses what he calls a swingling cylinder. This consists of four arms, each carrying a wooden knife. The hemp or flax is to be allowed to hang over a bar, or hanging piece, in such a way that the knives may operate upon it. There are, altogether, *two* fluted rollers between which the hemp, or flax, is to be passed. The lower is to be pressed against the upper roller by a weighted lever, or bar, in a well known manner. The claim is "the way of making the fluted rollers. The manner of weighting and graduating said rollers; also the manner of constructing the swingling cylinder, and hanging piece to swingle over."

What is the particular "way of making the fluted rollers," we are not told; and in fact, the whole machine is very imperfectly described, and badly represented in the drawing.

51. For an improvement in the art of *Manufacturing all kinds of Bottles, Decanters, and other pressed hollow Glassware,* with the neck or apertures smaller than the cavity or inside diameter of the vessel; John M'Gann, Kensington, Philadelphia county, Pennsylvania, November 26.

When a decanter, or similar vessel, is to be made, there are to be two moulds, with their proper presses. In one mould the lower part of the decanter is formed, in the other, the upper part and neck. One of the moulds is fixed to a hinge in such a way, that when the cores of the two parts are withdrawn, one mould will turn over upon the other, and bring the edges of the glass into exact contact, when, by a slight pressure, they are made to adhere; the moulds are then opened, and the decanter removed from it.

The claim is to that construction of the cores and moulds which enables the operator to form vessels of glass, in the way above described.

52. For an instrument for *Cutting Channels for Seams, in the Soles of Boots and Shoes;* James Cole, East Bloomfield, Ontario county, New York, November 26.

This instrument consists of a knife which projects from the end

of a piece, or pieces, of wood, formed in the manner of the shoulder piece, used by shoemakers.

The knife has a slot in it, and is fixed by means of a screw, allowing it to be set so as to cut to a greater or less depth. The claim is to the construction and use of such an instrument.

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53. For an improvement in the *Mode of Combining Printing Types for Music;* George Bruce, city of New York, November 27.

(See specification.)

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54. For a *Fan moved by Mechanism, for bed chambers, dining rooms, halls, &c.;* James Barron, Norfolk, Norfolk county, Virginia, November 27.

Four wheels and four pinions are to be fixed in a suitable frame. A barrel, like a clock barrel, with a weight and line attached to it, is to be wound up to keep the fan in motion. It is so calculated as to run about eight hours. A crank upon the shaft of the last pinion, gives motion to a rod, which is to vibrate like a pendulum rod; upon the end of this rod the fan is placed.

"The improvement here claimed is the above described machine for fanning bed chambers, dining rooms, halls," &c.

The foregoing is certainly a very complex mode of attaining the proposed object. We should find no difficulty in making a much more simple instrument for the purpose, and which certainly would not interfere with the claim to "the above described machine."

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55. For a *Thrashing Machine;* Samuel Turner, and Norris Barnes, Aurelius, Cayuga county, New York, November 27.

Another cylinder, and another hollow segment, are united together, and these twain, as heretofore, form one thrashing machine. The segment is to be of cast iron and fluted, the beaters are to be formed of square bars of wrought iron, and twisted, and "the particulars which the petitioners claim as their invention and improvement, are the reeded and fluted bed for the cylinder; and the peculiar position and construction of the Beaters on the cylinders. But they claim the right of every modification of said improvement, which is consistent with the principle of the same as herein described and specified."

There have been so many *modifications* of the same *principle*, previously patented, that the acquiescence of certain individuals in the claim here set up, is a point which verily admits of some doubt.

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56. For a *Thrashing Machine,* called Flagg's Rotary Thrashing Machine; David Flagg, jr. City of New York, November 29.

There are two, or more, cylinders with rows of teeth upon them;

the teeth of one cylinder being made to pass in the spaces between the teeth of its antagonist. We are told, however, that a hollow bed with teeth, may, in some cases, be substituted for one of the rollers.

The claim is to "the manner and form in which the cylinders operate together, as above described, for the aforesaid purposes."

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57. For a *Rotary Steam Engine and Boiler;* Caleb Tompkins, Montgomery, Montgomery county, Alabama, November 30.

The history of rotary steam engines, is a history of failures, in which much talent and money have been spent, and, hitherto, to no good purpose; many of the best practical engineers are now satisfied that the rotary will never supersede the reciprocating engine. The engine described by the present patentee, does not afford any thing new in principle, and its details are so imperfectly described, and so obscurely represented in the drawings, that it offers nothing to justify an augury in its favour. There is no claim made to any part. The anticipations of the patentee are, as is frequently the case, of a character somewhat too magnificent; they are manifestly theoretical, as we are very certain that a practical essay would have subtracted much from the sum entered on the credit side.

The boiler described is 3 feet in diameter, and 10 feet in length, and we are told that "this engine is capable of producing 200 horse power, as is calculated at present, and can be practically used in all cases where steam power may be required, for boats, carriages, factories, mills, and in all other places." "The use of this engine and boiler, will render the use of steam full fifty centum less expensive than those now in general use." Perhaps so, but we "have little hope, and no confidence."

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for improvements in the Saw Set. Granted to EBENEZER WHITING, *Berkshire, Tioga county, New York, October* 15, 1830.

To all whom it may concern, be it known, that I, Ebenezer Whiting, have invented certain improvements in the saw set, which improvements are applicable to saws of all descriptions, and that the following is a full and exact description of the same.

The saw set which I use operates upon the principle of punching, and is represented in the drawings which accompany this specification. Fig. 1, exhibits a convenient form for the saw set when used for hand, panel, or other similar saws. It has a shank by which it may be firmly fixed in a vice, or in a hole made in a bench for that purpose. The punch is sustained by a spring attached to the iron support, which is usually cast in one piece with the shank. A piece of tempered steel is let into the iron, immediately under the punch, and forms the bed between which and the punch the saw

tooth stands when it is to be set. There are two pins, or wires, which serve as guides to the saw teeth as they are successively set. The punch is filed so that its two sides which meet between the pins, form an acute angle, so as to be adapted to the form of a saw tooth. A plate of brass, or other metal, upon which the blade of the saw is to rest, is made to raise, or lower, by means of screws, which are tapped into the iron part of the frame through which they pass, and swivel in the plate above. A bent spring bears upon the heads of the screws, to retain them in their places. (See Fig. 1.)

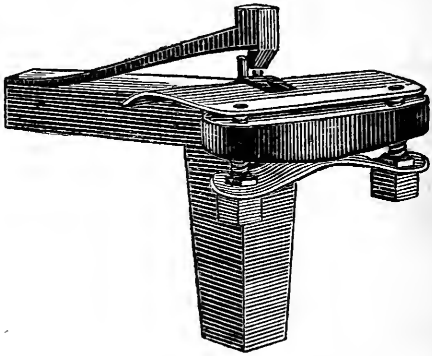


Fig. 1.

Fig. 2, is the same principle adapted to saw mill, cross cut, and other large saws. The pins which guide the teeth are not seen in the drawing, as they are hidden by the punch. They rise, however, from a steel bed, as in the former instance, and the punch, instead of being filed to an acute angle, is left square, and has two holes drilled in its face to admit the pins, and allow the punch to play. There are two screws by which to regulate the set of the saw, and also a bent spring. There is, on the back, a mass of cast iron which serves for a handle, and at the same time by its inertia, sustains the stroke of the hammer when a tooth is set.

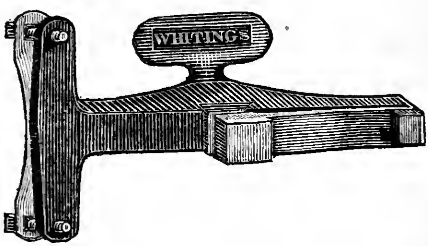


Fig. 2.

I do not claim the setting of saws by punching, the same having been heretofore practised; but what I claim as my improvements, are, the use of the two pins to guide the tooth of the saw; the making of the iron frame so that the limbs which contain the screws form a T with the body of the instrument; the mass of metal to prevent the recoil of the instrument when struck with a hammer; the manner

in which the set is regulated by means of the screws, and the general arrangement of the whole to produce the intended effect.

EBENEZER WHITING.

Specification of a patent for a machine for Scraping the Flesh and Hair from Hides and Skins in the process of Tanning, and for Dressing the same, and also for all other scraping necessary in tanning, currying, and leather dressing. Also for cleaning wool on sheep skins, and taking the same therefrom. Granted to THOMAS WILLIAMS, *Rochester, Monroe county, New York, November* 4, 1830.

THIS machine consists of a wooden frame, in which is set a cylinder of wood furnished with four knives of steel or iron, so placed upon the cylinder as to form obtuse angles on opposite sides of the same. The cylinder is turned by horse or water power, or may be turned by a crank by hand. The object of the knives is to scrape the flesh, or hair, from the hides or skins; the edges may be made sharp, or obtuse, according to the purpose for which they are used. The hide, or skin, is placed beneath the cylinder between that and a bed piece, which bed piece is so made as to fit the lower surface of the cylinder. The hide, or skin, is carried under the cylinder, and kept smooth by the angular and spiral position of the knives. The object of the bed piece is to press the hide or skin equally upon the edge of the knife. The pressure is regulated by a weight attached to two levers, by which the bed piece is raised or lowered. These levers are attached to a weight which consists of a box or trough filled with weights; or, instead of a trough and weight, a spiral spring. This weight is raised or lowered by means of another lever, placed on the frame work, above, and connected with the weight by a rod or line. There is a small cylinder placed parallel to the one above described, and turned by a crank. The object of this cylinder is to wind up the hide or skin after it has undergone the process of scraping from the knives; the hide or skin is attached or fastened to the last mentioned cylinder, by pressing a part of it into a long mortise with a bar made to fit the mortise. THOMAS WILLIAMS.

Specification of a patent for an Inking Apparatus; being an improvement on the inking apparatus of Neal's vertical press, and applying the same to other presses. Granted to RICHARD WOOD, *City of New York, November* 4, 1830.

IN the application of this machine, the operator in turning the rounce handle, in order to run the bed, or coffin, of the press under the platen, turns the arbor which is connected with the rounce, which, drawing upon the strap fastened upon the barrel contiguous to the bevel wheel, winds up the weight hung upon the barrel, upon

the sliding shaft to which this strap is attached; at the same time turning the two distributing rollers. In reversing the motion of the rounce, in order to withdraw the bed, the other barrel upon the arbor being held against the immoveable ratchet by the spiral spring, winds up the weight upon the other barrel of the sliding shaft; the motion of the arbor being reversed, the strap upon the other barrel unwinds from the barrel, and, the tympan being raised, pressing upon one of the levers before mentioned, bears off the barrel from the ratchet, and allows the strap on that also to unwind: the frisket being now raised; pressing upon the other lever, trips the catch which holds back the sliding shaft, and the weights now acting, one of them, hanging upon a strap which passes over a roller placed upon the back side of the fountain, draws the carriages with the shaft and fly wheels forward, and falling on the board fixed upon the lever placed across the lower part of the frame, bears down the lever and moves the fountain rollers; while the other weight, giving motion to the fly wheels, the elastic or composition roller, is made to pass twice over the form upon the press; by which time the strap that trips the catch which keeps the sliding shaft forward, having wound up, the stop at its end, trips the catch, and the weight continuing to descend, the straps extending from the sliding shaft to the arbor, having in the mean time been wound upon the shaft by its revolutions, so as to be drawn tight, the shaft is drawn back to its former position; bearing, in its return, upon the tail of the inking roller, which is raised from the fountain roller to the large distributing roller, and communicates to it a portion of ink. The operation may now be repeated.

The parts of this machine which I claim as my improvements and invention, besides its application to printing presses, other than "Neal's vertical printing press," are: the fixture for moving the catch which holds back the sliding shaft; that for moving the ratchet barrel upon the arbor, together with the rachet barrel; that for moving the fountain roller; the sliding rods and carriages; the longitudinal pieces at the ends of the frame, which give the arms of the roller a horizontal motion; the slot or range of holes in one spoke of each wheel, by which the roller may be made to traverse a greater or less space; the placing of the scraper of the fountain roller on the front side of the fountain by which ink may be more conveniently put into the fountain; and, the fixture for raising the inking roller from the fountain roller to the large distributing roller.

The advantages which the apparatus with my improvements possesses over Neal's apparatus, are: that, requiring much less weight, the apparatus is worked with proportionably less power; that, as the roller may be made to traverse a greater or less space, the apparatus may be adapted to forms of different magnitude, and, that the machine may be applied to printing presses in common use.

Richard Wood.

Specification of a patent for improvements on a mode of "Building Boats and Sea Vessels," patented on the 12th day of September, 1816. Granted to William Annesley, *Albany, New York, November* 6, 1830.

To all whom it may concern, be it known, that I, William Annesley, of the city of Albany, in the state of New York, did, on the twelfth day of September, in the year one thousand eight hundred and sixteen, obtain letters patent of the United States, for a mode "of building boats and sea vessels, without the ordinary timbers, excepting stem, stern posts, transom, gangway beams, and knees, by three or more courses of planking, on moulds, with tarred paper between each course." And that after many experiments, I have succeeded in making several improvements in my said mode of building vessels of all kinds, whether intended for river, or sea service, and that the following is a full and exact description of my said improvements, and of the manner in which the same are practically employed.

My former practice was to set up stem, stern post, and transom, with a fore and aft mould, outside from transom to stern, to give the fore and aft rake, and without kelson. My improvement in this part consists in laying a kelson, with the first fore and aft plank firmly attached to it, and projecting an inch, more or less, on which my vertical moulds rest, and using the interior fore and aft mould attached to the kelson.

My improved method of planking is effected as follows. My first fore and aft plank being parallel, and fastened to the kelson, I tack my spiling lath to the moulds, its edge bearing on the centre plank for a few feet, as a guide, and passing it up without bias, to the bow deck clamp, (or harping,) where it strikes, gives the curve of the centre fore and aft plank; the spiling being taken from the centre of the fore and aft mould to the inner edge of the lath, and transferred to the plank, having a centre line struck, and the spiling set off on each side, gives the lines of the first fore and aft plank, where the vessel is an equal figure from the centre. Thus, by having the planks parallel in the waist, a straight edge will lie along every seam when planked; being without stealers, or irregular figures, and one spiling will exactly fit all round, having the strike of equal width where the figure is equal. If not, it will require one spiling forward, and one aft, for every strake. The greatest possible strength is thus preserved in the planking, as the fibre of the wood is unbroken on the straight side. This may be perfectly understood by reference to the accompanying drawings.

When the first course is completed, it is payed over with a coat of pitch and oil, lime and tar, or some similar composition; and over this are placed sheets of tarred, or oiled, paper, as is likewise done between every course of planking; the process in this last particular being the same as in my former method of proceeding, is not claimed as making any part of my improvements.

A transverse course of planking is next to be laid on, from gunwale to gunwale, as far as the waist extends, to the rise fore and aft, it may be laid on in parallel straight plank, but where it begins to rise, spaces should be left equal to the breadth of the plank designed for use, to allow the plank free liberty to incline to the centre, and lie flat. The spaces are afterwards to be filled up by tacking a narrow thin lath in the centre of the space, and marking the distance between the edges of the plank, and transferring them to a plank having a centre line struck lengthwise and athwart, correctly, where the lath and centre of the bottom of the vessel correspond.

In vessels having an odd number of courses, as 3, 5, or 7, I place them alternately fore and aft, and athwart. For small boats, in two courses, I place the first outside, on the moulds, and bend in between the moulds the second, and remove the moulds as they interfere. When the moulds are removed the inner layer of planking is caulked, or wedged, and the outside may be caulked in the usual manner. But instead of caulking I have invented a mode of wedging, which I greatly prefer, and which I deem a very important improvement. The wedges which I use, are made of wood, and are a little longer than the thickness of the plank to be wedged, in order that the edges may bend, and thus key, when they come in contact with the planking beneath that to be wedged. The wedges, before they are driven, are dipped into white lead paint, which forms a perfect water proof cement.

In order to give a practical idea of my mode of procedure, I present the following account and description of the building of the De Witt Clinton steam vessel, at Ithaca, on Cayuga lake, in the state of New York. This vessel having been recently built, will serve to exemplify the improvements on my former patent, for which I now claim an exclusive right.

This vessel is 100 feet long on deck, her extreme breadth 18 feet 6 inches, her depth of hold 8 feet $10\frac{1}{2}$ inches, and consists of four courses, as follows. First course, $1\frac{1}{8}$ inch thick, white oak plank. The second and third courses are each $\frac{3}{4}$ inch thick, placed transversely, in succession. The fourth, or outside course, is $1\frac{1}{4}$ inch in thickness, making altogether a thickness of $3\frac{7}{8}$ inches. The kelson, 65 feet in length, is of pine, 12 by 9 inches; with a centre plank 11 inches wide; it was laid on four uprights, sunk two feet, and rising three feet six inches above ground, and well braced. On each upright was placed 4 wedges, in two courses, all levelled fore and aft, and athwart; one pair to be driven out to permit the transverse planking to pass under, and then to be replaced to relieve the others. Her kelson was laid level, it being necessary to launch her broadside. Her fore and aft and vertical moulds being set up, the deck clamps, of two inch oak plank, 10 inches wide, in two courses, were fastened to the moulds by small iron clamps and screws, all being well braced. The perfect accuracy with which vessels can be built upon this plan, was evinced by the laying on of the first course of plank without the slightest alteration being required in the moulds.

The first course was laid with 20d. cut nails, and hutchocks, or

wood stops, to permit them to be drawn; it was then thoroughly coated with pitch and oil. The second course of plank was bent round transversely, from gunwale to gunwale; the plank used was $\frac{3}{4}$ inch thick, and was fastened with 6d. cut nails; the wood stops being split off, and the nails of the former course drawn, as they interfered. A layer, or coat, of pitch and oil, was applied as before, and upon this one of oiled paper. The third course of $\frac{3}{4}$ inch oak plank, was laid in the same manner as the last, observing to break joints therewith. The fourth and last course of planking, which was $1\frac{1}{4}$ inch thick, was fastened with cut nails, 4 inches in length, and having square heads. The nails were prepared by heating them to redness, carefully, and equally, and plunging them in that state into fish oil; a film is thus spread over them which forms an impervious varnish, protecting them against rust for an indefinite length of time.

In laying this last course, after the centre fore and aft plank was first secured, its edges were then covered with a coat of stiff white lead paint, and every succeeding plank was treated in the same way; the whole outside seams being painted when the planking was finished; the moulds being then removed, the inside was caulked in the usual way.

The next operation was the wedging of the outside, to which I have already referred. The wedges were made of poplar, (or white wood,) and cut by tools made for the purpose, by which they were all cut to the same size. Those used were $4\frac{1}{2}$ inches wide, $1\frac{1}{2}$ inch long, 3-10 thick at the back, and 1-10 at the edge. The seams were opened in the usual manner, the points of the wedges dipped in stiff white lead paint, and driven nearly flush. When planed off, the whole surface exhibited an appearance of peculiar neatness, and of the most perfect solidity.

Two engine sills of 60 feet in length, 12 by 10 inches, were placed on each side of the kelson, at a foot apart; they were screw bolted through the bottom; there being bridging pieces of 2 inch pine plank, at 2 feet apart.

The bulk heads, four in number, were formed of two courses of inch pine plank, one course being upright, and the other horizontal. Their distance was such as to allow 65 feet for the length of the main cabin floor. This floor was also laid in two courses, the first athwart, and the second fore and aft. It was of $1\frac{1}{4}$ pine plank.

The stem, or cutwater, was now bolted on, leaving a rebate to receive the first fore and aft planking of the gripe. The stern also was cut through, to receive the stern post, which measured 14 by 10 inches, and rebated to receive the fore and aft planking of the dead wood, astern.

There are five beams athwart this vessel, three of which serve to support the boilers, which are carried on the wings.

In sailing vessels I use no beams, or carlines, but place two additional plank athwart, at the openings, to receive the comeings of hatchways, cabin, &c.

The decks of the De Witt Clinton were formed on the same prin

ciple with the body, being in three courses. Fore and aft pieces were fixed temporarily to give the curve to the deck. The upper course of planking was wedged, in the way before described.

When this vessel was completed, the vibration occasioned by the working of the engine, was scarcely perceptible. She was so tight, as to render it necessary to pump water into her to sweeten her; and three inches of water being kept in her, was, by absorption and evaporation, reduced to two, in 36 hours.

In large vessels for sea, I now form my moulds from a model, (cut into sections) of a figure to permit my cross planking to pass entirely round the waist, as far as the harpings, fore and aft. Thus forming, internally, an eliptic barrel, between the forward and aft bulk heads. To give the outside form, I place brackets at proper distances, and I continue the outside planking up. I sometimes form solid water ways of pine wood, in two or more courses, into which I mortise for my stanchions, plank up with oak, and place an oak plank for a cap, and to project, forming a moulding entirely round the gunwale.

Having thus given a description of my present mode of procedure in forming the hull of the vessel, I will now detail those particular improvements which I have made upon the methods used by me when my first patent was obtained; referring for a more perfect understanding thereof, to the drawings which accompany this specification, and to the explanatory references made thereto. I have also deposited a model in the patent office, built upon a scale of $\frac{1}{4}$ inch to the foot.

In my former plan, a stern post and transom were set up. This mode is now rejected. In my improved mode I lay the kelson, with the first fore and aft plank laid on it, and projecting on each side an inch, more or less, on which the upright moulds rest. This I claim as new.

I now lay permanent deck clamps, in two or more courses, which are continued all round on the moulds, and attached to them by small iron clamps, and wood screws, to be drawn when the moulds are removed. I also lay my first course fore and aft with hutchocks, (or wood stops.) These methods I also claim as new.

The continuing the planking entirely round the waist, into the fore and aft deck clamps, and placing brackets, or water ways to form the outside, as above described, I claim as new.

I claim likewise my present method of planking in the fore and aft courses, whereby each plank has one straight edge, in consequence of which a flexible lath, the edge of which is straight, will lie to every seam. I claim also my manner of taking the spiling of the transverse courses, as explained in the account of the De Witt Clinton.

Instead of my former manner of setting up the stern post, the inserting of it through the body of the vessel above the deep water line; and the fitting my stem after the body is planked, caulked, or wedged; and the building my keel, where great length and depth are required, in courses, and gripe, and dead wood, as before described, and shown in my drawings, are claimed by me as new.

I likewise claim the substitution of wedging for the ordinary mode of caulking, in the manner and for the purposes herein described.

The method of laying the deck for open vessels, (that is, those not continued round entire in the transverse courses,) I claim as new. This consists in employing three or more courses, the first two laid athwart, and the upper course fore and aft, upon the principles and in the manner hereinbefore set forth.

WILLIAM ANNESLEY.

Abstract of the specification of a patent for a new mode of uniting Timber together, so as to combine great strength, compactness, and durability; which is applicable to many purposes in the business of civil architecture and engineering, such as the building of Bridges, Aqueducts, Domes, and many other structures. Granted to WILLIAM ANNESLEY, *Albany, New York, November* 6, 1830.

To all whom it may concern, be it known, that I, William Annesley, of the city of Albany, in the state of New York, have invented a new mode of uniting timber together, so as to combine great strength, compactness, and durability. This invention is applicable to many purposes in civil architecture and engineering, such as the building of bridges, aqueducts, domes, and many other structures. The general principle upon which I proceed being the same as that which is detailed in a specification or description of my mode of "building boats, and sea vessels;" for which I have applied to obtain letters patent of the United States, in an instrument of writing bearing date with the present.

And I do hereby declare that the following is a full and exact description of my said invention, and of the manner in which it may be carried into effect.

For the purpose of exemplification I have chosen a "groined arch bridge," an "aqueduct," and a "dome;" not, however, intending to restrict myself to these in the application of my invention, the essential feature of which is the forming of the structure, whatever it may be, by uniting together two, three, or more thicknesses, or layers, of plank or boards, some of which layers cross the others transversely; the whole being bent, or formed upon moulds, and closely united together, so as to be impervious to water, and to retain the shape given to them, after the mould by which it has been determined, is removed.

For a bridge, abutments are to be built in the usual way, and sills of the most durable timber being placed three or four feet from the faces of the abutments, are levelled to the curve of the arch, and firmly built in with stone and mortar. Uprights of suitable lengths, and at convenient distances apart, are fixed in the bed of the river, and properly braced, they rising to the height necessary for supporting the intended arch. The curve of the arch having been marked

on these uprights, they are to be cut off fair to these marks. The first course of outside string pieces, are then laid, and fastened to the tops of the uprights by iron clamps and wood screws, which are afterwards to be drawn. This first course may be 10 or 12 inches in width, and four in thickness. A second plank course, of the same dimensions, is then laid on, breaking joints with the first. The arched transverse beams are then fixed in their places, and filled in between in two courses, as shown by the dotted lines; the upper one being trimmed to the transverse curve. These are all to be fastened together with oak pins. The first course of the centre string is now laid on and pinned to the beams, and the second laid flush with the beam and pinned. On these I commence laying my first course of groin arch, of two inch pine, using the longest plank which I can obtain. They are all made truly to a width, and bevilled to fit the transverse curve, and fastened to the beams with long cut nails. The next course of plank is laid athwart, pine $1\frac{1}{4}$ inch in thickness will answer. The third course may be 2 inches in thickness; a fourth transverse course, similar to the second, is then laid, and this is followed by the fifth, or last course. In laying this upper course longitudinally, the jointed edges of the plank should be coated with good white lead paint. The seams are afterwards to be wedged, in the manner described in the specification of my mode of "building boats and sea vessels." The last plank being 2 inches, the wedges should be $2\frac{1}{4}$ inches long, 3-10 thick at the back, and 1-10 at the edge; those which I have used were $4\frac{1}{2}$ inches wide, and were made of poplar, (white wood.) The seams are to be opened, as for caulking, the wedges dipped in white lead paint, and driven home, so as to clinch upon the transverse timber below.

The cut nails used may be preserved from rust by heating them red hot, and plunging them in fish oil; and between each course of planking, the whole surface should be payed over with pitch and oil, or some similar article; oiled paper also should be interposed throughout, between every layer, or course, of plank.

My plan of uniting timber may be applied to aqueducts, either open or close. When it is desired to erect an aqueduct at once in its proper place, a scaffolding must be raised to support it, as in bridge building. Aqueducts may also be built in sections, and these afterwards elevated, and united together.

The mode of procedure being generally the same with that followed in the building of bridges, I deem it unnecessary again to go into details.

What I claim as new, is, the uniting together of layers of wood in longitudinal and transverse courses, in the manner herein described, either in the building of bridges, aqueducts, or other structures; and generally the application of the same principle which I have adopted in the building of boats and sea vessels, to the erection of structures on land.

WILLIAM ANNESLEY.

Remarks by the Editor.—The space occupied by the foregoing specifications forbids our making any extended remarks upon the

merits of Mr. Annesley's plans. We know, however, that he has devoted many years of his life, and expended large sums of money, in bringing them to their present improved state. In the building of vessels in particular, to which he has principally devoted his attention he has necessarily, at every step, had to encounter the self-interest, and the honest prejudices of the ship builders. His method is, as regards their business, a revolutionary measure, and should it eventually supersede the long established method of building vessels, it is not likely that he will ever reap the reward of his labours. Innovations of the description proposed, are rarely accomplished in a single generation.

That his plan of uniting timber will insure to his structures a greater degree of strength than can be obtained from the same weight of material, combined in any other way, we have no doubt. The strongest objection which presented itself when the plan was new to us, arose from an apprehension that the infiltration of water between the layers, would produce early decay. We, however, are assured, that after the experience of many years, no such effect has been produced.

Whether his mode of building may be as advantageously applied to the construction of the larger class of ships as to vessels of a smaller size, may admit of doubt: that those of considerable burthen may be so built, and that they will be strong and durable, has been abundantly proved, although constructed in a way much less perfect than that now adopted. We understand that Mr. Annesley is likely to have an early opportunity of building a government vessel upon his principles.

We have given but a small portion of the second specification, as our only object was to present the main features of the invention. The skilful mechanician will have no difficulty in perceiving how it may be applied to domes, aqueducts, and other structures.

Specification of a patent for a Labour-saving Tanning Apparatus. Granted to William Brown. *City of New York, November* 11, 1830.

The improvement herein claimed by the subscriber, is the connecting and concentrating of the various processes through which the hides pass before they become leather, by means of suitable machinery, into one apparatus, the construction of which is as follows.

There are four, or more, leatches, or cisterns, for infusing the bark, which are placed contiguous to the handlers, or vats, on the same level, but projecting at the top above them. These leatches, or cisterns, communicate with each other by means of tubes, inserted between them near the tops, and are supplied with false bottoms, which fit loosely, and which are perforated with holes, forming a kind of strainer. In each of the leatches is fixed an aqueduct or tube, which is used to convey the liquor from the bottom to the communicating tubes. By this contrivance the liquor is passed

from the bottom of one leatch, into the top of the adjoining one, where it acquires a fresh portion of strength, and is thus propelled through the whole series, by pouring the water or weak liquor into the tops of the leatches, until it being of sufficient strength, arrives at the fourth or strongest leatch. There is also placed in one corner of each of these leatches, what is called an eye, which consists of a trunk projecting below the bottom of the leatch, and connected to a horizontal pipe, which serves to convey the liquor, when of sufficient strength, directly to the handlers, or vats; this trunk is supplied with a plug for regulating the quantity of liquor thus drawn off.

At a convenient distance from the leatches, and on the same level with them, is placed a heater, which consists of two or more horizontal copper, or iron, pipes, which are placed one above the other, and have connecting tubes near their ends. These pipes are attached to and communicate with another, of a square form, in which the fire is made. These pipes, or heaters, are secured within a cistern, with their ends projecting at one side, and have caps for the convenience of cleaning.

It will be seen that when a fire is kindled in the lower heater or box, the heat passes from it into the tube above at its farthest extremity, and comes forward and enters the next above, and so goes backward and forward until it enters the chimney at the opposite side, thus transmitting all the heat of the fire, to the liquor with which the cistern is constantly filled. There is a tube communicating with the heating cistern for supplying it with weak liquor or water, and communicates at its opposite extremity with a trunk or reservoir, which is furnished with a pump, by which the liquor is raised to the tube and forced into the heating cistern, which is kept constantly full by this means; the heated liquor passing off at a different tube, which communicates directly with the leatches. The leatches are filled with bark by means of a conveying trough communicating with the elevators of the mill.

The strong liquor or infusion passes from the bottom of the leatches as before mentioned, into a trunk passing into a horizontal position under them, and rises by a vertical tube inserted in said trunk, from which it is transmitted to another horizontal trunk communicating with the handlers, or vats, and passing along their upper surfaces. By this method the liquor from the leatches is transmitted into the tops of the handlers, or vats. At the bottom of the vertical tube, and within the lower horizontal trunk, is placed a valve moveable by means of a strap extending up through the said tube. This valve is to prevent the stronger liquor from entering the reservoir, and thus mixing with the weaker.

The liquor after having passed through the handlers, or vats, is drawn from their tops by means of a hollow plug inserted into the lower trunk before mentioned, and runs into the trunk or cistern, from whence it is again transmitted to the heaters, and so on to the leatches; so that the same liquor is continually in use; the evaporation and waste of which is supplied by water.

In each of the handlers is a reel, or cylinder, formed by two circular heads secured at the required distance apart by longitudinal bars; and having gudgeons which work in slides, for the convenience of elevating or depressing them at pleasure. The hides are secured on the inside of the reels by means of hoops, which encircle the reels a short distance from their heads, and have pins on their outer surfaces by which the hides are fastened; or they may be thrown loose into the reels.

The great saving of labour in this invention consists in the facility with which the hides may be kept in motion when immersed in the liquor. Each of the reels has a rag wheel attached to it, and is turned one notch at a time, by means of a shaft which is geared into a click, to be worked by hand, or may be moved by animal, water, or steam power. The piston of the pump in the trunk or reservoir, is attached to one of the shafts, and may be moved or unshipped at pleasure.

There is what is called a beam house connected with this apparatus, where the hides are first limed before they are put on the reels. The water which is necessary to mix the lime, is heated and supplied on the same principle as before mentioned for the leatches; and the piston of the pump attaches in a similar manner to the shaft. In laying away hides, it is necessary to have the ground bark which is put between them, moistened or damped, to prevent waste and dust. The contrivance for this purpose consists of a small cistern, elevated at a convenient height, and supplied with a spout perforated with holes, and a cock for regulating the quantity of water required to wet the bark, which is placed under it. The subscriber claims the privilege of using his improved labour-saving tanning apparatus, on as large or small a scale as he may require, and with any number of leatches and handlers. WM. BROWN.

Specification of a patent for a new and useful method of supplying the Boilers of Steam Engines with Water. Granted to JOHN S. WILLIAMS, *Maysville, Mason county, Kentucky, November* 17, 1830.

1. THERE must be a water chamber placed at the horizontal level, with the height the water is intended to maintain in the boiler, or boilers, intended to be supplied.

2. The water chamber must open into the supply water by a communication furnished with a valve opening toward the water chamber. The supply water must be higher than the water chamber, so as to run in of itself, or be forced in by a pump, or be drawn in by a vacuum.

3. The water chamber must open into the boiler intended to be supplied, below the height of the water it is intended to maintain in the boiler, by a communication furnished with a valve opening into, or towards the boilers.

4. The steam in the boiler above the water must open into the

water chamber above mentioned, by a communication which can be opened or shut at pleasure.

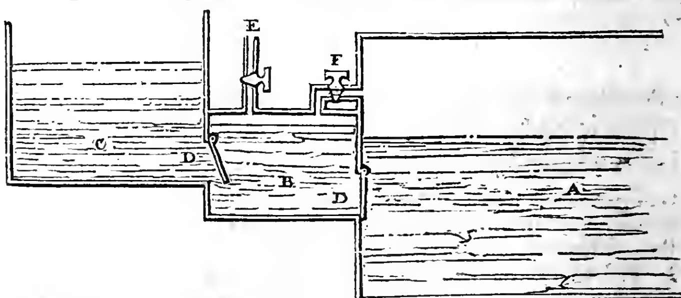
5. The water chamber must open upwards into the atmospheric air, or a vacuum, by a communication that can be opened or shut at pleasure.

It is evident from the principles of hydrostatics, that if the steam of the boiler be shut out of the water chamber, and the communication be opened upwards from the water chamber into the atmospheric air, or a vacuum, that the supply water will flow through the communication described in the second head, above, and fill the water chamber.

It is equally evident that if that communication described in the 5th head above, be then closed, and the steam in the boiler be let into the water chamber, by the communication described in the 4th head above, that the water in the water chamber will flow into the boiler through the communication described in the 3d head above, until the water in the water chamber, and that in the boiler, shall maintain one level.

It is also evident that by alternately opening and shutting the two communications described in the 4th and 5th heads above, that the water chamber will be alternately filled with supply water, and emptied into the boiler, as long as the alternate opening and shutting are continued. Hence it appears that the supply of water in the boiler will not only be kept up from without, but that it can never rise higher nor sink lower in the boiler than a line above the level of which the water chamber shall have sufficient capacity to supply the water in the boiler during one operation of alternately filling and emptying the water chamber. JOHN S. WILLIAMS.

Explanation of the drawing illustrative of the apparatus.



A, boiler. B, water chamber. C, supply water. D, D, valves. E, F, cocks. When the cock, E, is open, and F closed, the pressure in the boiler will close the valve between it and B, and the supply water will flow into the water chamber, through the valve between it and C. Shut E, and open F, and the steam from the boiler will pass into B, its pressure will close the outer, and allow the inner valve to open, when the water will flow into the boiler, and stand at the same level in it and in the water chamber.

The capacity of the water chamber above the water line, must be equal to the waste of the water in the boiler during the filling and emptying of the water chamber. And if the operation of alternately opening and shutting E and F, be kept up, the water in the boiler will never rise higher nor sink lower than the water line, while the supply water continues in C.

Specification of a patent for an improvement in the mode of combining Printing Types for Music. Granted to George Bruce, *City of New York, November 27,* 1830.

In combining printing types for music in the manner here contemplated, the lines of the staves are formed with separate rules, and the characters are cast in sections, or pieces, to occupy the spaces between the lines or rules, being cut, or divided by the rules, wherever they intersect, and forming with them perfect characters.

I claim as my invention the use of separate rules, which, in combination with suitable types adapted to the spaces, between the rules, shall form perfect characters of any required description. By this method the lines of the stave are more perfect than by the old method of casting characters and lines together; kerned types are unnecessary, the number of characters is reduced, the use of them in printing facilitated, and the cost decidedly diminished.

George Bruce.

Accompanying the foregoing specification are two specimens of printing with the types described. One of them the sections of types without the rules, which exhibits the spaces which the rules are to occupy. The other the types combined with the rules. Its appearance is neat and distinct, and we think it a real improvement on the former modes of casting types for printing music.

ENGLISH PATENTS.

To Thomas Prosser, *Architect, a patent for Certain Improvements in the construction of Window Sashes, and in the mode of hanging the same.* September 6th, 1830.

Mr. Prosser proposes in this specification to attach the upper and lower sashes, to the same lines which pass over a pulley attached to each side of the frame near the top of the window. These are of the kind usually called side pulleys, which have their axes at right angles to the surfaces to which they are attached. The small frames in which the pulleys turn, are moveable in dovetailed grooves in the window-frames, and adjustable by a screw to regulate the tension of the sash-lines. The two sashes are thus made to balance each other, entirely obviating the necessity for the metallic counterpoises usually employed to facilitate the raising and lowering of the sashes. From this description, it will be perceived that one of the sashes

cannot be moved without moving the other, so that the opening can never be made entirely either at the top or bottom of the window, but an equal portion of it will be at each.* The method of attaching the line to the sashes, consists in tying neatly to the ends of the lines small pieces of metal, with longitudinal rectangular slits, which pass over T studs, fixed into the sashes with their heads across, by which the lines are secured from being accidentally detached when once they are hooked on. Instead of the beads, which are generally fixed to the frame on each side of a window-sash, as guides to keep it in its place while stationary, and to preserve their perpendicular position while elevated or depressed, this patentee fixes a single rod into the frame, which fits accurately into a groove in the side of the sash. This constitutes a fitting less pervious to the weather than that usually adopted, at the same time that it affords great facility in cleaning the windows; for, as the guide-rod of the lower sash does not extend more than half way down, so that the lower sash being elevated to the top of the window escapes its guide-rod, and may be turned inside out, and the upper sash being lowered to the bottom, may be similarly reversed, and by this means all parts of the window can be brought within reach of a person in the room, for the purpose of cleaning or repairing.

The improvements here contemplated seem to be all good; but we consider the last mentioned will be extensively adopted, and become very useful; for the present method of cleaning the outsides of high windows is attended with much danger and inconvenience, or with much injury to the fittings by the frequent removal of the side beadings. [*Register of Arts.*

To WILLIAM *and* ANDREW RAMSAY, *and* SAMUEL ORR, *Sail Makers, for an improvement in the manufacture of Canvass and Sail Cloth, for the making of sails.* September 20th, 1830.

THE improvements contemplated by these patentees, consist in a method of making sail-cloth, or canvass, with the yarn constituting the weft in an oblique position, instead of crossing the yarn constituting the warp at right angles, according to the usual manufacture. To effect this the working parts of the loom, such as the batton frame and batton, the lames, the reed, &c. are made to shift upon the side frames to any required angle, and arranged so as to be secured by clamping or screwing, to preserve the necessary position during the weaving of any one piece of the canvass. The slits of the reed must be placed at the same angle with respect to its frame, as the frame itself makes with the side frames of the loom, that the reed may move freely between the threads constituting the warp.

* There is no novelty in the above mode of hanging sashes, as a patent was obtained for it in the United States, twelve or fourteen years since.

[EDITOR.

It will be perceived, that these modifications are equally applicable to the hand and power loom.

The advantages which canvass manufactured in this way possesses over that manufactured from yarn of the same quality, with the weft crossing the warp at right angles, is, a greater degree of strength when the principal tension or strain upon the sail, is made to coincide with the direction of the threads of the warp or weft, and this can always be done with sail-cloth manufactured as above described, for the sails are strained by application of force to the corners. This circumstance must, however, be attended to by the sail maker. [*Ib.*

To SAMUEL ROBERTS, *Silver Plater, for certain improvements in Plating or Coating of Copper or Brass, or mixtures of the same, with other metals or materials, or with two metals or substances upon each other; as also a method of making such kinds of articles or utensils, with the said metal when so plated as have hitherto been made either entirely of silver, or of copper or brass, or of a mixture of copper and brass, plated or coated with silver solely.* September 20th, 1830.

THE improvements invented by this patentee, consist in introducing a layer of white metal, as that mixture of zinc, nickel, and copper, denominated "*German Silver,*" between the metal to be plated, and the silver with which it is plated. The advantage of this invention is, that when the silver wears off in parts, the defects are not readily perceived, as the under metal is very nearly of the same colour. The German silver is to be applied by a process precisely similar to that usually adopted in plating, and the real silver is then to be applied to the compound metal, which is to be moulded into form either before or after the process of plating, as circumstances may require. [*Ib.*

To WILLIAM AITKIN, *Esq. for certain improvements in the means of keeping or preserving Beer, Ale, and other Fermented Liquors.* September 24th, 1830.

IT has been long the practice to keep the fermented liquors either in casks or glass bottles, closely stopped, to prevent the escape of the carbonic acid gas, by which liquors would become flat. The preference being given to the plan of keeping it in small bottles, as far as regards the quality of the ale, beer, &c. for this enables the consumer to prevent any being exposed to the atmosphere, except the quantity which he may require for use at any one time. But this plan has been found too expensive for general introduction.

Now to unite the advantages of the bottles, with the economy of

the barrels, is the object of Mr. Aitkin's patent, and he proposes several methods of carrying the object into effect; in all of which he preserves the liquor under pressure, to prevent the escape of the carbonic gas. One plan is to make the barrel cylindrical, with an air-tight piston moveable within it; that it may be forced down upon the surface of the beer, by a screw or otherwise, whenever a quantity is abstracted for use. Another method is to introduce within the cask, which may be made of the usual form, a kind of elastic bag or vessel, of sufficient capacity to fill the cask. This bag must be made of materials impervious to air and moisture; and as the beer is withdrawn, the bag is expanded to occupy the place, by injecting air or water: and thus an uniform pressure is preserved upon the beer as long as any remains in the cask. [*Ib.*

To RICHARD IBOTSON, *Paper Manufacturer, for an improvement or improvements in the method or apparatus for Separating the Knots from Proper Stuff or Pulp, used in the manufacture of paper.* November 29th, 1830.

HITHERTO much difficulty has been experienced in clearing the stuff or pulp of which paper is made, of the small knots, which are invariably found in it, and which, if not separated, necessarily diminish the quality of the paper. The sieves or strainers which have been generally employed for separating the knots, have been either so wide in the meshes as to permit the smaller knots to pass through, or else they very soon get clogged up, for it is evident that the fibres of which even the finest paper is made, are considerably longer than one of the meshes in the sieve, and hence they will, instead of passing through, be deposited across the meshes, and immediately render the sieve useless.

To remedy these imperfections, Mr. Ibotson manufactures his sieves or strainers, which he applies to the paper machines distinguished by the term Fourdrinier's machines, of metallic bars, giving the preference to gun-metal, made flat on the upper surface, and about half an inch wide, or at all events of a width greater than the length of any of the fibres in the pulp. The bars are strengthened, by a projection extending along the middle of their lower sides, so that the cross section of one of the bars may be represented by the letter T. These bars are in a frame at a distance from each other, corresponding with the intended quality of the paper for which the sieve is to be used. He has designed, however, a very ingenious method of adjusting the distances between the bars, so as to make the sieve answer for the manufacture of paper of different qualities. For this purpose he makes all the bars to taper uniformly, and fixes every alternate bar with its narrow end towards the same side of the sieve; and he frames the other bars together, but does not fix them to the sieve; they are introduced between the fixed bars with their narrow ends in a contrary direction. By this arrangement it is evident that the distances between may be diminished or increased to any

degree of nicety, with the greatest facility, by pushing the frame of loose bars forwards or backwards, which is effected by means of adjusting screws. The sieve is to be placed in a trough conveniently situated, to receive the pulp from the hog or machine by which the rags are torn to pieces, and agitated into the consistence of pulp. One side of the sieve, which is made of the form of a rectangular parallelogram, is attached by hinges to the trough, and the other is connected with a set of cam-wheels, by which it is elevated and depressed with great rapidity; and when the sieve gets clogged up by the knots which it separates from the pulp, its surface is to be cleaned by a rake or brush, made of hard bristles. This seems to be a highly ingenious invention, and in the hands of a practical man as it is, it cannot fail to become useful to the public. [*Ib.*

To JAMES HOLMES BASS, *Gentleman, for certain improvements in machinery for Cutting Corks and Bungs.* December 3d, 1830.

MR. Bass having prepared the cork by cutting the sheets into blocks, of the length of the required cork, and of a width corresponding with the thickness of the sheet from which they are taken, fixes the blocks successively between two chucks, in a kind of lathe, by which a slow rotary motion is communicated to them, while a frame knife is brought in contact with the circumference of the intended cork; the plane of the blade being made to coincide with a tangent to the curve. To give to the cork the requisite degree of tapering, the knife is made to approach nearer to the axis of motion at one end than the other. To the knife frame, which is supported on cams of different sizes, which are to be brought into action according to the size of the cork or bung to be cut, a sawing or slicing action is communicated by cranks and connecting rods, from the main shaft of the apparatus. As a great portion of the sheet of cork imported into this country is too thin to be cut into circular corks, of the required size for common bottles, it has been the practice of cork cutters, to make their corks somewhat elliptical, in order to save material; finding that the compression of the cork in one direction will expand it in another, and make it form, though of an elliptical shape, a perfect stopper to a circular opening. To accommodate his machine to this economical mode of cutting, Mr. Bass makes his cams which support the knife frame, of an elliptical form; and as the rotation of the cams are made to coincide with the rotation of the cork holders, the corks will be cut of an elliptical form, as if they had been manufactured by hand.

The principle and arrangements of this machine are highly creditable to the ingenuity and judgment of the patentee, who will doubtless reap the benefit of his labours. [*Ib.*

To John Wilks, *Engineer, Millwright, and Machinist, one of the copartners in the firm of* Bryan, Donkin, & Co. *Engineers, Millwrights, and Machinists, for an improvement or improvements in a part or parts of the apparatus for making Paper by Machinery.* October 24, 1830.

The improvement contemplated by this patentee, is, the application of an additional roller to the machines used in the manufacture of paper, and known by the name of Fourdrinier's paper machines. The additional roller is to be perforated, and it is intended to facilitate the escape of the water from the pulp web, previously to its being subjected to the pressing rollers. Still more to facilitate the abstraction of the water, Mr. Wilks proposes to employ the pressure of the atmosphere, by making a vacuum within that part of the perforated roller on which the paper web rests.

The method of making these rollers is described to consist of the following processes. A piece of sheet copper, brass, or other suitable metal, is bent and soldered in the form of a tube, whose length is equal to the circumference of the intended roller, and whose circumference is equal to the length of the intended roller, making an allowance for the waste at the ends. The tube is then to be drawn on trebletts, in the usual manner, and afterwards turned truly cylindrical on the mandril on which it was drawn. A series of grooves, eight or ten in number, are then turned half through the tube, with a tool the sixteenth of an inch wide, and so made as to make the bottoms of the grooves as wide as their tops. The tube is then taken from the mandril, cut open, and bent inside out and soldered in the form of another tube, whose length shall correspond to the circumference of the first, thus constituting a hollow cylinder with longitudinal grooves inside. It is to be again drawn and turned with grooves to the amount of twenty-four in the inch, these will of course cross the other at right angles, and being cut half through as before, the entire surface will be composed of transverse ridges and rectangular perforations.

When it is desired to employ the exhausting principle, a second perforated cylinder is introduced with the first. The inner cylinder must be made smooth inside, that it may fit air tight upon a sectoral cavity extending from the axes to the circumference, enclosing about an eighth part thereof, opposite to the place covered by the web of paper as it passes over the roller. The air is pumped from this cavity through the axis, which is made hollow for that purpose, by an air pump of the usual construction. When this method of abstracting the water is employed, the roller must be put in motion by a train of wheel work, so arranged that it may coincide precisely with the motion through the machine. [*Ib.*

To George Harris, *Captain in the Royal Navy, for improvements in the manufacture of Ropes and Cordage, Canvass, and other fabrics or articles, from substances hitherto unused for that purpose.* Enrolled March, 1830.

The object of this invention is to produce a rope, or sail cloth, which shall be impervious to water.

The patentee proposes to employ as the substance of his improved ropes or cordage, a vegetable production, called *silk grass*, which, when dried, is to be beaten and heckled in the same manner that flax or hemp is usually prepared. In the process of preparing the grass, it is proposed to introduce a bituminous and gummy material, which is intended to saturate the fibres of the grass, for the purpose of preserving the ropes, cordage, or sail cloth, or any other fabric made from it, when exposed to the effects of damp.

This gummy material is to be compounded of the milk of a tree called the *ficus indica*, with *aspultum*, or *bitumen judaicum*, and *cocoa nut oil.* The proportions are to about twenty-five gallons of the milk, one gallon of the oil, and from one to twenty gallons of the bitumen, according to circumstances.

These substances when properly combined, which may be done over a slow fire, constitute a gummy material, into which the fibres of the grass may be dipped while heckling, and it also may be applied in twisting or spinning. It is likewise proposed that the workmen in twisting the strands of cord, shall dip their hands in the material, and work it well into the fibres and texture of the rope.

When this gummy material has become dry, it will resist water, and prevent the rotting effects of damp upon the fibres of the rope, cordage, sail cloth, or other articles manufactured from it.

[*Lond. Journ.*

To William Fawcett, *Engineer, and* Matthew Clark, *Engineer, for their invention of an improved apparatus for the better Crystallization of Sugar from the Canes.* Enrolled June, 1828.

The leading feature of this invention is the application of high pressure steam to the external surfaces of sugar pans or vessels in which the cane juice is boiled, for the purpose of concentrating its crystals, that is, evaporating the aqueous parts from the sugar.

Any peculiar form or disposition of the vessels does not appear to be essential; but such an arrangement must be adopted, as will allow of the steam from a high pressure boiler to be brought in contact with, or surround, the several pans in which the molasses, or cane juice, is placed for evaporation.

It is proposed to construct a very strong steam boiler of wrought or cast iron, having the furnace and flues within surrounded by the water, so that little or no heat may be lost by radiation. This boiler is to be proved to bear the resistance of steam at a pressure

considerably greater than it will ever be required to be employed, and safety valves are to be placed in suitable situations, to prevent explosion. On the top of this boiler the sugar pans are to be mounted, with jackets surrounding their lower surfaces, connected by flanches packed steam tight. From the boiler, pipes are to be laid, for the purpose of conducting the high pressure steam into the spaces between the pans and their jackets, the heat of which will cause the molasses, or cane juice, in the pans, to boil, without subjecting it to burning, or baking on to the internal surface of the pan.

The pans may be connected in any other way with a generator of high pressure steam, which steam may be conducted under the pans by pipes or other means, and the steam boiler or generator may be employed at the same time to drive the engine, or other machinery connected with the sugar works.

The ends of the flues in the boiler are to discharge themselves into other flues leading to the chimney, but they must be furnished with dampers, to prevent the heat from passing away too freely; and additional pans may be placed in connexion with the chimney or flues, by which the heat of the vapour and smoke may assist in preparing the liquor for the crystallizing process. [*Ib.*

To HENRY ROPER, *Esq. a Rear Admiral in our Royal Navy, for his having invented a new and improved system of Signals; first, for communicating by day, by the means of flags and pendants between ships at sea, or other objects far distant from each other; in which system the colours of the flags and pendants which have heretofore served to distinguish the signals one from another, and which by distance or other causes are extremely subject to be mistaken, may be dispensed with altogether; and, secondly, for communicating by night, between ships at sea and other objects far distant from each other, by the means of lights; and which system of signals is more conspicuous, expeditious, and certain, than any which has hitherto been employed for the like purpose.* Enrolled August, 1827.

THE features of this invention are almost as fully described in the above title as in the specification itself. The object of the patentee does not appear to be that of altering altogether the system by which signals or telegraphic communications are made from one ship to another at sea, but to simplify the process, by forming the subjects intended to be communicated into classes, and adapting to each class of subjects, peculiar signals at the onset, leading to the kind of correspondence intended to be carried on. By so doing the number of signals, consisting of flags and pendants, are reduced from forty-eight, the ordinary complement, to only twenty-two, and of course are less expensive, more easily worked, and not so liable to mistake as when a greater number are employed.

These signals are intended to represent numerals, and by being

placed at different elevations, point out whether units, tens, hundreds, or thousands; and the number thus shown, referring to a signal book, indicates by the corresponding number in the book, the word or sentence designed to be expressed.

The device upon the flag or pendant is sometimes to be the signal, at other times the colour of the flag or pendant is to be the significant mark, and at night time lanterns, with coloured glass of divers shapes, are to be employed instead of flags.

In conjunction with these, balls and other marks are to be occasionally employed; but as the specification does not point out the modes of working them, (which indeed depends upon the previous arrangement of the sentences, word, or syllable, in the signal book,) it would be useless for us to extend our description of the patentee's views further. [*Ib.*

On SHALDER'S *patent Fountain Pump.*

[To the Editors of the London Journal of Arts and Sciences.]

GENTLEMEN,—Of all machinery adapted to the general uses of life, none is so universal, and none more important than that which is constructed for the purpose of raising water from one situation to another. It therefore follows that any improvement by which this object may be effected with greater facility, convenience and despatch, becomes of the highest value to the world, and as far as regards mechanical invention, is of greater consequence in this than in any other species of machinery.

To prove this assertion, it would only be necessary to point out the numerous attempts which have been made to accomplish this desirable end. It has been the research of learned and scientific men; but many centuries have elapsed, and we have still found the same mode handed down to us, with all its acknowledged imperfections. In the invention which I am about to introduce to the reader's notice, every former deficiency is remedied, and the object required is produced by the most direct and satisfactory means, leaving no desideratum; and there is no doubt, from the strong testimonials of its efficacy, that in the course of a short time this invention will wholly supersede every other method at present in use.

When the principle of this fountain pump is thoroughly understood, its advantages are sufficiently obvious, and to those who do not comprehend its construction, or are at a loss to perceive its peculiar mode of action, I need only refer to the numerous demonstrations of its superiority. These facts decide at once in its favour.

I am now only speaking of its comparative working properties, and increased power in raising water; but when to these it is added that the fountain pump is more durable, more economical, and more simple in its construction, there can be no hesitation in yielding to it the most decided preference, whether applied to the arts, navigation, or domestic purposes.

In the common pump, when properly made, the piston should fit

the inside of the working barrel so closely as to form a perfect vacuum, that the leather or packing may press hard against the sides of the cylinder; this consequently produces, when the pump is in action, an irregular, unsteady resistance, while independently of the unnecessary waste of power to counteract friction, produces an uneasy stiffness in motion, which soon wearies the performer. By the advantages possessed in the invention under consideration, no friction occurs, and these defects are wholly obviated.

With the common pump, solid substances, as hard pieces of wood, particles of sand, &c. &c. are very apt to insinuate themselves between the bucket and the barrel; these may either unpack the piston, or by grinding and tearing the leather, or forming grooves in the barrel, render it totally unserviceable, until it again passes through the hands of the maker. In this improvement the connecter is so constructed as to cast up and deliver solid substances with as great facility as it does the fluid, and without the possibility of injury or derangement to the workmanship.

In the pump constructed upon the new principle, the bucket is surrounded by a strong pliable leather tube, which I call the connecter, of a conical figure, or the diameter of one end is rather less than that of the other; this is supported by the expresser or bucket when in movement, and easily admits of being inverted and retroverted. Its lesser circumference is closely secured to the upper and outer extremity of the expresser; and the larger circumference is fastened to the inner part of the cylinder between two flanches. This effectually precludes the possibility of leakage, as the connexion is completely cut off between the upper and lower portion of the barrel, except through the valve of the bucket. Thus we have the three grand defects of the common pump, from friction, choking, and leakage, entirely remedied; besides, as before stated, less original expense, less wear and tear, and greater simplicity.

The operation of the pump on the improved plan may be compared to the action of lifting through the air a bucket of water, suspended to the counter end of a lever, or pump handle. Supposing the bucket at each depression of the handle to empty itself, and to refill at each elevation, we have a representation of its mode of action, there being neither more nor less friction in resistance in the one instance than the other. There is only the weight of the water to contend with, and so ample is the power gained by the adaptation of the new principle, that double the work may be accomplished in a given time; in other words, that one man may perform the work of two; or what would occupy a man two days to complete, may be finished in one day.

The following is a description of this invention given by a scientific gentleman of acknowledged talent:—"This improvement is designed to avoid the friction of an ordinary pump, by substituting in place of the usual air and water tight packing of the piston or bucket, a flexible tube or diaphragm surrounding the bucket, which rises and falls with it. Fig. 1, represents the bucket with its diaphragm and other appendages detached from the pump and shown in perspective.

Fig. 2, is a geometrical section of the same taken through the middle perpendicularly; and Fig. 3, is a plan or horizontal view of the same, as it would appear when seen from above. In all which figures similar letters refer to corresponding parts; *a, a,* is the bucket or piston of the pump, having two valves, *b, b,* opening upwards as usual; *c, c,* are bent arms, for the purpose of attaching the bucket to the pump rod at *d,* by which the bucket is to be raised and lowered in the pump barrel, by means of the pump handle, or by any other common contrivance.

Fig. 1.

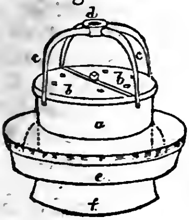


Fig. 2.

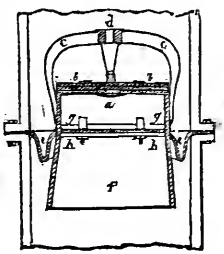
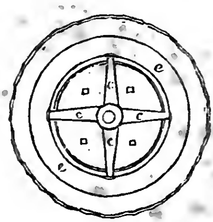


Fig. 3.



"The diaphragm, *e, e,* is a tube of leather or other suitable flexible material, which is air and water tight. It is made from a disk of leather, rather larger in diameter than the interior of the pump barrel, in the centre of which a circular hole is to be cut, rather smaller than the interior of the bucket, which gives it the form of a broad ring; this ring of leather is then soaked and pressed upon a block until it is brought into the form of a frustrum of a cone, very much resembling in shape a round hat, with the centre of the crown removed; the frustrum having a narrow rim at bottom on the outside, and a similar rim at top on the inside, which two rims are for the purpose of attaching the diaphragm to the pump barrel, and to the bucket.

"To the lower part of the bucket a cylindrical or bell formed tube, *f,* is attached, for the purpose of preventing the diaphragm from collapsing under the bucket when the pump is in action. At the lower part of the bucket there is an internal flanch, *g, g,* and a corresponding flanch, *h, h,* at the upper part of the bell formed tube, which two flanches take hold and confine the inner rim of the diaphragm, and are held together by screws, bolts, and nuts, as seen in Fig. 2. The outer rim of the diaphragm is in a similar way held securely between flanches in the pump barrel, and by these means the upper and lower parts of the pump barrel are separated, and an air and water tight partition formed, without packing the bucket as in ordinary pumps.

"It will now be seen that on the ascent or descent of the bucket, the diaphragm being flexible, will readily rise and fall, leaving the water way clear, and effecting all the purposes of a tight bucket or piston, without producing any of the friction which results from the employment of a bucket fitted closely to the barrel, as in pumps of the usual construction."

Experiments have been frequently made with this improved pump, by introducing sand, fragments of wood, gravel, apples, &c. &c., yet any substance capable of passing the valves has been ejected along with the water, without the least impediment or detriment. There is likewise a large body of evidence from practical manufacturers, who have made use of the fountain pump for different purposes, for various periods, from one to four years; these distinctly assert its manifest superiority, and amply confirm the character just given of it.

The patent pump is confidently recommended to engineers, as being the most efficient machine to remove or supply large bodies of water. By the aid of the steam engine its operations would be prodigious, while the saving of fuel and attendance would reduce the expenses by one half. To water companies it will shortly become an essential auxiliary, and it will be the duty of those who have the public trust reposed in them to employ it. The same observations will apply to mining operations, either to those conducted by public associations, or by private individuals; with them it is indispensable, as it is the only machine not liable to embarrassment by the presence of sand, gravel, &c. &c. It is well known that many mines, after much delay and expense, have been abandoned from this very cause.

To road surveyors its utility is conspicuously pointed out; in watering the roads, despatch is requisite, as the watering ought to be finished in the early part of the day; double the number of carts may be engaged at once, and the whole be completed in one-quarter the time, and at half the expense.

To breweries it will become a necessary appendage, as it may be easily removed from one place to another; the work will be concluded in one-half the time, or boys may be substituted for men, which, in the course of a year, will produce a material saving. The same remarks are applicable to tanneries, to pump the water and ooze; in distilleries, the wash and spirit; and in dye houses, the dye, &c.; for these purposes the pumps may be constructed of wood, &c. at a very trifling prime cost. For brickmakers, excavators, &c. it is the only pump suitable to their purposes.

The utility of the pump is so general, that it may be said that no establishment of any description is complete unless so provided; in the house, in the garden, in the stable yard, pumps on this improved principle are most particularly adapted, as children or females can work them with the greatest ease, and when out of order, though seldom, they may be repaired without the aid and expense of a plumber.

For the purposes of agriculture in dry seasons, they may be employed on an extensive scale to irrigate the land, as the labour of supplying water is so materially diminished; and when used for the purpose of drainage, large tracts of land may be brought into cultivation.

In nursery grounds and large gardens, where diffusion of water is so essential, they will become a valuable acquisition.

In our West India possessions, and other colonies, where large supplies of water are required for cattle, and numerous other ser-

vices, the fountain pump will become a necessary apparatus; those they have in use at the present time, are, generally speaking, extremely defective; this circumstance arises from the common pump being so soon out of order, from its defect in principle, and from being little understood, except by workmen, who most usually reside at a distance.

Proprietors of estates are, therefore, particularly enjoined to direct their attention to this object, as they can always have the independent means of possessing a superior and more powerful machine, easily repaired, and attended with infinitely less expense. Those who desire to have the ordinary friction pump process replaced by one on the new plan, have no necessity to alter the former arrangement of pipes, machinery, &c.; it would only be requisite to supply a new cylinder and expresser. The principle of the improvement can also be applied to the forcing pump, where it still preserves its extraordinary advantages. For fire engines, deep wells, and to supply elevated situations, it is admirably calculated. In short, to those who are zealous in real improvement, or have economy in view, the fountain pump is earnestly recommended as a machine whereby much time and outlay will be ultimately saved; in every instance where a pump is required, it is infinitely superior, and in some instances it will not admit of substitution.

I am, gentlemen, yours, &c.

John Elliott,
Civil Engineer.

Remarks on the different Modes of Applying Power for Locomotive Purposes.

Sir,—The subject of rail-ways and steam-conveyance at present occupying so much of the public attention, the following brief remarks, on the different modes of applying power for the purpose of locomotion, may not be thought inconsistent with the objects of your publication. In the late exhibitions which took place on the Liverpool and Manchester Rail-way, the tremendous velocity of the engines exceeded not only the most sanguine expectation of the public, but the engineers even who designed and constructed them, have been agreeably surprised at the gratifying results of their own labour and ingenuity. By these performances the opinion which was formerly entertained of the speed in travelling, concomitant with safety, having experienced such an extraordinary revolution, we are prompted to look forward to the future, and endeavour, by taking an impartial view of the subject, to ascertain the limit at which the progressive advancement of improvement will eventually terminate.

The great object which constantly requires to be kept in view in advancing and perfecting the art of locomotion, whether on rail-ways or common roads, is to find out the best and most efficient mode of stowing, economizing, and applying a certain quantity of power, or momentum, sufficient to impel the appended load to a convenient dis-

tance by overcoming the retarding forces, which are always co-existent with every kind of motion. The most important causes of this continued retardation, are the attrition and cohesion of all those parts of an engine, or carriage, which come in contact with each other. Before a carriage, however, has attained the requisite velocity, the moving power has to overcome the whole inertia of the mass corresponding to this velocity; and this at first, and afterwards, when the velocity varies, forms a considerable item in rail-ways of the force required to be exerted in locomotion. When different inclinations obtrude themselves on rail-ways and roads, another cause of retardation presents itself, which requires to be particularly observed when considering the best mode of applying power in overcoming these several obstacles. In the use of them for this purpose, the mode of its generation and application introduce a material waste of power, which it appears impossible to obviate, from no means being applicable for regulating, exactly, the quantity of heat evolved in combustion, or of economizing it by condensing the steam after it has performed its duties. In the usual manner, likewise, of estimating the steam power required to be exerted in moving the same load at different velocities, any increase in the latter is always accompanied by an equal augmentation of the former. But since no difference exists in any of the retarding forces, except that of the increased inertia at first opposing its resistance, it follows that the quantity of power supplied is greater than the force required to be overcome. This waste ensues principally from the rapid vibration of the piston, impeding the transference of the full power with which the steam is charged, and might perhaps be partly obviated by using cylinders of different lengths and diameters, connected by corresponding leverage in such a manner, that although the momentum was sufficient to supply the requisite power, yet the velocity of transference should be at first moderate, and afterwards, by a combination of machinery, gradually augmented till sufficient for direct application to the wheel. But the existence of the other difficulties which have to be encountered, and which have been already enumerated, must completely baffle the success of such expedients.

On the whole, when we contemplate the application of steam power to overcome a resisting force which continually varies, it appears altogether inadequate to sustain that system of economy which it is necessary to preserve. It has presented such serious obstacles to locomotion on common roads, as have, as yet, entirely prevented its successful application; and on rail-ways, although the general effects are striking, on moving over a level track, yet on ascending an inclination of even one in ninety-six, the velocity of the carriage is so far retarded, that if the length of such an inclination exceeded two or three miles, an entire stoppage might be expected, if some more important improvements in the steam locomotives are not effected. In looking forward to the future, therefore, we are warranted to expect some new modification of the system, which may prove adequate to accomplish all that can be desired in remedying the defects which are here taken notice of, and approaching finally

the goal of perfection. The following analytical observations, by ascertaining and examining the causes of insufficiency, appear to hint at these requisite modifications, although the adoption of the views here taken of this subject, must be entirely influenced by the judgment derived from the practical experience of professional men.

From what has already been observed, it will have been rendered obvious that the steam-engine works to most advantage, when it communicates adequate force by a moderate velocity of the piston; to apply this kind of power, therefore, to the purposes of locomotion, an intermediate agent becomes necessary, which, by receiving the continued and unvaried supply, may act as a reservoir of force, which could always furnish the exact quantity of power competent to sustain the carriage at the same velocity. This agent requires to unite portability with the capability of receiving and transmitting the same power without loss; it must be, therefore, elastic and of a minimum weight; in fine, an aeriform fluid appears in the most perfect manner to be endued with all the requisite essentials for this purpose. We are in this manner led to the direct conclusion, that the most expedient method of supplying power to a locomotive carriage is from a reservoir of condensed air, which may be continually replenished by the unvarying action of steam. In condensing air, when no time is allowed for the heat to dissipate, the mass acquires an increase of temperature equal to one degree of Fahrenheit's scale for every condensation equal to 1-480 of the whole bulk. Thus, when the chamber which contains the air is small in comparison to the velocity of condensation, a quantity of heat will be extricated, which will materially add to the elastic force, and therefore to the power required to be applied, which will be immediately lost in the reservoir from the balance of temperature being restored. To remedy this, it becomes necessary that the primary condensation takes place in a large chamber, where time might be allowed for the superabundant heat to disperse. But this is not concomitant with the maximum bulk, which it is necessary both engine and reservoir should occupy in a locomotive carriage; a separation must therefore ensue, and whilst the steam-engine is stationary, the reservoir of the locomotive might be supplied by others of superior magnitude, appended to a stationary engine situated at each end of the rail-way, if not exceeding 30 or 40 miles in length, or when longer at convenient intermediate stages. By following this mode of arrangement, the air would have an equal temperature, and, from the size of the chamber affixed to the carriage, the contained air, during the process of exhaustion, would have time to supply the transient deficiency of temperature from the ambient atmosphere, whilst the velocity of its motion would tend further instantaneously to restore the equilibrium.

Many particulars are, however, to be minutely considered before the practicability of this mode of storing up power can be demonstrated; the most important of them shall here be attempted to be submitted to rigorous calculation, although practical proof can alone establish the efficacy of the principles upon which it is founded.

The elasticity of air augments in a ratio nearly equal to that of condensation; since the pressure, therefore, of the atmosphere is nearly 15 lbs. on the square inch, when condensed air is confined in a vessel it will exert on a square inch of its surface a pressure equivalent in pounds to 15 times the number of enclosed atmospheres. If the power of traction be represented by the constant impeding force, multiplied by the space gone over, the momentum of elasticity contained in the reservoir, calculated in a similar way, must be equivalent to this product. Thus, if the space required to be gone over in inches is represented by S, the constant force of retardation in pounds by W, the contents of the reservoir in cubic inches by C, and the number of contained atmospheres by A, then $SW = \frac{15\,A^2C}{2}$: if any three of these quantities are therefore given, the fourth may be found by this equation. If A is supposed constant, and equal to 50, while we reckon W = 500, which, on a level rail-way, is sufficient to draw a load of about 45 tons; the contemporaneous values of S and C may be exhibited in miles and cubic feet, forming the two first columns of the following table:—

S in miles	C in cubic feet	C increased five times	Diameter of spherical chamber.
1	.978	4.890	2.106
5	4.890	24.450	3.601
8	7.824	39.120	4.212
10	9.780	48.900	4.537
12	11.736	58.680	4.822
15	14.670	73.350	5.191
18	17.604	88.020	5.517
20	19.560	97.800	5.716
25	24.450	122.250	6.157
30	29.340	146.700	6.541
35	34.230	171.150	6.886
40	39.120	195.600	7.202

The third column represents the values of C, increased five times, that the whole quantity, which is required to be abstracted from the reservoir, may not introduce any inconvenient change of density; which, by varying and lessening the expansive energy, may render it inapplicable to the machinery through which it acts. The fourth column shows the dimensions of the reservoir, considered as spherical, although two or more smaller vessels may contain together as much as one of larger dimensions, without requiring a greater weight of metal (see note A.)

Note (A.) If t represents the thickness of the shell of a spherical chamber, D its diameter, p the pressure on its internal surface, and M the modulus of cohesion of the substance composing the shell, then $p\,D = 4\,M\,t$. Let δ represent

In ascending any inclination, the extra force required to be expended will be proportioned to the load multiplied by the whole height of ascent. In addition, therefore, to the whole distance on rail-ways and roads considered as level, there must be included the sum of the heights of all the ascents which occur in this distance, and the power expended in both, estimated according to the foregoing methods, will give the full quantity required to be supplied to a locomotive carriage. To illustrate this, let the Liverpool and Manchester Rail-way be taken as an example. The whole length is 29 miles, which, by the third column of the table, gives the number of cubic feet 141.8. In proceeding from the west to the eastern termination of the rail-way, the sum of all the ascents amounts to 230 feet; and although the descents amount to 141 feet, which will materially lessen the power required to be exerted, yet this advantage may be overlooked from the impossibility of exactly estimating it; and the quantity of condensed air to be allowed for the rise of 230 feet will amount to $500 \times 200 \times 230 = SW = \frac{15\ A^2 C}{2}$, or $C =$ S.5 and $5\ C = 42.6$. The whole number of cubic feet will therefore be 184.4, which is the contents of a spherical chamber, 7 feet in diameter, or of two, $5\frac{1}{2}$ feet each. We may, therefore, consider a reservoir of these dimensions, when applied to a locomotive carriage, sufficient for the conveyance of a load of 45 tons, the whole length of the Liverpool and Manchester Rail-way.

Various mechanical expedients suggest themselves as necessary apparatus, to connect the store of power with the wheels of the carriage; but, indeed, little difficulty can be experienced in suiting the arrangements of machinery to the exigencies which present themselves, although they must differ considerably from the usual mode of forming the cylinder and valves of the steam-engine, and must

the evanescent linear magnitude of supposed distension; the increment of surface corresponding to the assumed diameter $D + 2\,\delta$ will be $4\,\pi$* $D\,\delta + 4\,\pi\,\delta^2$, which also represents the virtual velocity of the cohesive momentum of the spherical shell. This being equably distended, the force will be equally exerted in every direction, and may be resolved into two which shall be equal and perpendicular to each other. If the substance of the shell, retaining the original thickness, was arranged in the form of a square, the virtual velocity in the direction of one side will be represented by $2\,\pi\,D\,\delta$, and, multiplied by Mt, gives the virtual momentum of cohesion $= 2\,\pi\,D\,\delta\,Mt$. The virtual momentum of pressure, which is to counterbalance this, being half the aggregate of the distending force on the whole surface will be represented by $\frac{1}{2}\,\pi\,p\,D^2\delta$, which being equal to $2\,\pi\,D\delta\,Mt$, by reducing the equation, we have $4\,Mt = p\,D$ or $t = \frac{p\,D}{4\,M}$, $D = \frac{4\,M\,t}{p}$ and $p = \frac{4\,M\,t}{F}$. Thus, if we suppose the elasticity of air proportional to its density, the quantity of material necessary to confine, by this mode, the same quantity of power, is always constant, whatever be the diameter of the spherical chamber; for quantity of power $\propto p\,D^3$ and quantity of material $\propto t\,D^2$, but $p\,D^3 \propto 4\,Mt\,D^2 \propto t\,D^2$, therefore $p\,D^3 \propto t\,D^2$.

* π Here represents the ratio of the circumference of the circle to its diameter.

be accommodated to variations in the elasticity of the condensed air, and in the velocity of the carriage.

The next subject of any importance to be considered in estimating the expediency of the system, is the weight of the reservoir and necessary appendages of the carriage, that a comparison may be instituted between this and the present weight of locomotives, with the fuel and water necessary to carry them 30 miles. From the formula before demonstrated (see note A,) the thickness of an iron spherical chamber, 7 feet in diameter, perfectly sufficient to sustain pressure of 50 atmospheres on its internal surface will be 1.05 inches, and the whole metal required $= 7^2 \times 3.1416 \times .0875 =$ 13.468 cubic feet; which, at 480 lbs. per cubic foot, amounts to 2 tons 18 cwt. and estimating the attending machinery and framework of the carriage as a maximum at 1 ton, we have about 4 tons for the whole weight of the carriage, which would be reduced to $2\frac{1}{2}$ if it renewed its supply, like the steam-engine, at the end of 15 miles. Thus it competes with the lightest locomotive that has yet been constructed, that if the weight of the water and fuel, which must accompany every steam locomotive, be included in the estimate, it must eventually display a decided superiority.

[TO BE CONTINUED.]

On Gunpowders and Detonating Matches. By Andrew Ure, M. D. F. R. S. &c.

(Concluded from page 112.)

3. *On the Charcoal.*

Tender and light woods, capable of affording a friable and porous charcoal, which burns rapidly away, leaving the smallest residuum of ashes, and containing, therefore, the largest proportion of carbon, ought to be preferred for charring in gunpowder works.

After many trials, made long ago, black dogwood came to be preferred to every plant for this purpose, but modern experiments have proved, that many others afford an equally suitable charcoal. The woods of black alder, poplar, lime tree, horse chesnut, and chesnut tree, were carbonized in exactly similar circumstances, and a similar gunpowder was made with each, which was proved by the same proof mortar: the following results were obtained:—

	Toises.	Feet.
Poplar—mean range, - - - -	113	2
Black alder, - - - - - -	110	4
Lime, - - - - - - - -	110	3
Horse chesnut, - - - - - -	110	3
Chesnut tree - - - - - - -	109	

By subsequent experiments, confirmatory of the above, it has been further found, that the willow presents the same advantages as the poplar, and that several shrubs, such as the hazel nut, the spindle tree, the dogberry, the elder tree, the common sallow, and some others, may be as beneficially employed; but whichever wood be

used, we should always cut it when full of sap, and never after it is dead; we should choose branches not more than five or six years old, and strip them carefully, because the old branches and the bark contain a larger proportion of earthy constituents. The branches ought not to exceed three-quarters of an inch in thickness, and the larger ones should be divided lengthwise into four, so that the pith may be readily burned away.

Wood is commonly carbonized, in this country, into gunpowder charcoal, in cast iron cylinders, with their axes laid horizontally, and built in brick work, so that the flame of a furnace may circulate round them. One end of the cylinder is furnished with a door, for the introduction of the wood and the removal of the charcoal; the other end terminates in a pipe, connected with a worm tube, for condensing the pyroligneous acid, and giving vent to the carburetted hydrogen gases that are disengaged. Towards the end of the operation, the connexion of the cylinder with the pyroligneous acid cistern ought to be cut off, and a very free egress opened for the volatile matter, otherwise the charcoal is apt to get coated with a fuliginous varnish, and to be even penetrated with condensable matters, which materially injure its qualities.

In France the wood is carbonized for the gunpowder works, either in oblong vaulted ovens, or in pits, lined with brick work or cylinders of strong sheet iron. In either case the heat is derived from the imperfect combustion of the wood itself to be charred. In general, the product in charcoal by this method, is from sixteen to seventeen parts by weight, from one hundred of wood. The pit process is supposed to afford a more productive return and a better article, since the body of wood is much greater, and the fuliginous vapours are allowed a freer escape. The surface of a good charcoal should be smooth, but not glistening.

The charcoal is considered, by the most scientific manufacturers, to be the ingredient most influential, by its fluctuating qualities, on the composition of gunpowder; and therefore it ought always to be prepared under the vigilant and skilful eye of the director of the powder establishment. If it has been kept for some time, or quenched at first with water, it is unsuitable for the present purpose. Charcoal, extinguished in a close vessel by exclusion of air, and afterwards exposed to the atmosphere, absorbs only from three to four per cent. of moisture; while red hot charcoal, quenched with water, may lose by drying twenty-nine per cent. When the latter sort of charcoal is used for gunpowder, a compensation in weight must be made for the water present: but charcoal, which has remained long impregnated with moisture, affords a most detrimental constituent to gunpowder.

4. *On mixing the Constituents and forming the Powder.*

The three ingredients being thus prepared, are ready for manufacturing into gunpowder; they are, 1st, separately ground to a fine powder, which is passed through proper silk sieves or bolting machines; 2nd, they are mixed together in the proper proportions,

which we shall afterwards discuss; 3d, the composition is then sent to the gunpowder mill, which consists of two edge stones of a calcareous kind, turning by means of a horizontal shaft, on a bed stone of the same nature, incapable of affording sparks by collision with steel, as sand stones would do. On this bed stone the composition is spread, and moistened with as small a quantity of water as will, in conjunction with the weight of the revolving stones, bring it into a proper body of *cake*, but by no means to a pasty state. The line of contact of the rolling edge stone is constantly preceded by a hard copper scraper, which goes round with the wheel, regularly collecting the caking mass, and bringing it into the track of the stone. From fifty to sixty pounds of cake are usually worked at one operation under each mill stone. When the mass has thus been thoroughly kneaded and incorporated, it is sent to the corning-house, where a separate mill is employed to form the cake into grains or corns. Here it is first pressed into a hard firm mass, then broken into small lumps, after which the corning process is performed by placing these lumps in sieves, on each of which is laid a disk or flat cake of *lignum vitæ*. The sieves are made of parchment skins, perforated with a multitude of round holes. Several such sieves are fixed in a frame, which, by proper machinery, has such a motion given to it, as to make the *lignum vitæ runner* in each sieve move about with considerable velocity, so as to break down the lumps of the cake, and force its substance through the holes, in grains of certain sizes. These granular particles are afterwards separated from the finer dust by proper sieves and reels.

The corned powder must now be hardened, and its rougher angles removed, by causing it to revolve in a close reel or cask, turning rapidly round its axis. This vessel resembles somewhat a barrel churn, and is frequently furnished inside with square bars, parallel to its axis, to aid the polish by attrition.

The gunpowder is finally dried, which is now done generally with a steam heat, or in some places by transmitting a current of air, previously heated in another chamber, over canvass shelves, covered with the damp grains of powder.

5. *On the Proportion of the Constituents.*

A very extensive suite of experiments, to determine the proportions of the constituents for producing the best gunpowder, was made at the Essonne works, by a commission of French chemists and artillerists, in 1794.

Powders, in the five following proportions, were prepared:—

	Nitre.	Charcoal.	Sulphur.	
1	76	14	10	Gunpowder of Bâle.
2	76	12	12	Gunpowder works at Grenelle.
3	76	15	9	M. Guyton de Morveau.
4	77.32	13.44	9.24	Idem.
5	77.5	15	7.5	M. Riffault.

The result of more than two hundred discharges, with the *proof mortar*, showed that the first and third gunpowders were the strong-

est, and the commissioners in consequence recommended the adoption of the third proportions; but a few years thereafter it was thought proper to substitute the first set of proportions, which had been found equal in force to the other, as they would have a better keeping quality, from containing a little more sulphur and less charcoal. More recently still, so strongly impressed have the French government been, with the high value of durability in gunpowders, that they have returned to their ancient *dosage* of seventy-five nitre, twelve and a half charcoal, and twelve and a half sulphur. In this mixture the proportion of the substance, powerfully absorbent of moisture, viz. the charcoal, is still further reduced, and replaced by the sulphur or the conservative ingredient.

If we inquire how the *maximum* gaseous volume is to be produced, from the chemical reaction of the elements of nitre on charcoal and sulphur, we shall find it to be by the generation of carbonic oxide and sulphurous acid, with the disengagement of nitrogen. This will lead us to the following proportions of these constituents:—

	Hydrogen=1	Per Cent.
1 prime equivalent of nitre,	102	75.00
1 " " sulphur	16	11.77
3 " " charcoal	18	13.23
	136	100.00

The nitre contains five primes of oxygen, of which three, combining with the three of charcoal, will furnish three of carbonic oxide gas, while the remaining two will convert the one prime of sulphur into sulphurous acid gas; the single prime of nitrogen is, therefore, in this view, disengaged alone.

The gaseous volume, on this supposition, evolved from one hundred and thirty-six grains of gunpowder, equivalent in bulk to seventy-five grains and a half of water, or to three-tenths of a cubic inch, will be, at the atmospheric temperature, as follows:—

	Grains.		Cubic inches.
Carbonic oxide, - - -	42	=	141.6
Sulphurous acid, - -	32	=	47.2
Nitrogen, - - - -	14	=	47.4
			236.2

being an expansion of one volume into 787.3. But as the temperature of the gases, at the instant of their combustive formation, must be incandescent, this volume may be safely estimated at three times the above amount, or considerably upwards of two thousand times the bulk of the explosive solid.

But this theoretical account of the gases developed, does not well accord with the experimental products usually assigned, though these are probably not altogether exact. Much carbonic acid is said to be disengaged, a large quantity of nitrogen, a little oxide of carbon, *steam of water, with carburetted and sulphuretted hydrogen.* From experiments, to be presently detailed, I am convinced, that the amount of these latter products, printed in italics, must be very

inconsiderable indeed, and unworthy of ranking in the calculation; for, in fact, fresh gunpowder does not contain above one *per cent.* of water, and can therefore yield little hydrogenated matter, nor is the hydrogen in the carbon of any consequence.

It is obvious, that the more sulphur is present, the more of the dense sulphurous acid will be generated, and the less forcibly explosive will be the gunpowder. This is sufficiently confirmed by the trials at Essonne, where the gunpowder that contained twelve of sulphur and twelve of charcoal in one hundred parts, did not throw the *proof shell* so far as that which contained only nine of sulphur and fifteen of charcoal; the conservative property is, however, so capital, especially for the supply of our remote colonies, and for humid climates, that it justifies a slight sacrifice of strength, which at any rate may be compensated by a small addition of charge.

Table of Composition of different Gunpowders.

	Nitre.	Charcoal.	Sulphur.
Royal Mills at Waltham Abbey,	75	15	10
France, national establishment,	75	12.5	12.5
French, for sportsmen,	78	12	10
———, for mining,	65	15	20
United States of America,	75	12.5	12.5
Prussia,	75	12.5	12.5
Russia,	73.78	13.59	12.63
Austria,	76	11.5	12.5
Spain,	76.47	10.78	12.75
Switzerland, (a round powder,)	76	14	10
Chinese,	75	14.4	9.9
Theoretical proportions, (as above,)	75	13.23	11.17

6. *On the Chemical Examination of Gunpowders.*

I have treated five different samples; 1. The government powder, made at Waltham Abbey; 2. Glass gunpowder, made by John Hall, Dartford; 3. The treble strong gunpowder of Charles Lawrence and son; 4. The Dartford gunpowder of Pigou and Wilks; 5. Superfine treble strong sporting gunpowder of Curtis and Harvey. The first is coarse grained, the others are all of considerable fineness. The specific gravity of each was taken in oil of turpentine; that of the first and last three was exactly the same, being 1.80; that of the second was 1.793, reduced to water as unity.

The above density for specimen first, may be calculated thus:—

75 parts of nitre, specific gravity = 2.000
15 parts of charcoal, specific gr. = 1.154
10 parts of sulphur, specific gr. = 2.000

The volume of these constituents is 55.5, by which, if their weight, 100, be divided, the quotient is 1.80.

The specific gravity of the first and second of the above powders, including the interstices of their grains, after being well shaken down in a phial, is 1.02. This is a curious result, as the size of the grains is extremely different. That of Pigou and Wilks, similarly tried, is

only 0.99; that of the battle powder is 1.03, and that of Curtis and Harvey is nearly 1.05. Gunpowders thus appear to have nearly the same weight as water, under an equal bulk; so that an imperial gallon will hold from ten pounds to ten pounds and a half, as above shown.

The quantity of water that 100 grains of each part with on a steam bath, and absorbed when placed for twenty-four hours under a moistened receiver standing in water, are as follows:—

100 grains of Waltham Abbey, lose 1.1 by steam heat, gain 0.8 over water.

Hall,	0.5	2.2
Lawrence,	1.0	1.1
Pigou and Wilks,	0.6	2.2
Curtis and Harvey,	0.9	1.7

Thus, we perceive, that the large grained government powder resists the hygrometric influence better than the others; among which, however, Lawrence's ranks nearly as high; these two are, therefore, relatively the best keeping gunpowders of the series.

The process, most commonly practised in the analysis of gunpowder, seems to be tolerably exact. The nitre is first separated by hot distilled water, evaporated, and weighed. A minute loss of salt may be counted on, from its known volatility with boiling water. I have evaporated always on a steam bath. It is probable, that a small proportion of the lighter and looser constituent of gunpowder, the carbon, flies off in the operations of corning and dusting; hence, analysis may show a small deficit of charcoal below the synthetic proportions originally mixed. The residuum of charcoal and sulphur, left on the double filter paper, being well dried by the heat of ordinary steam, is estimated, as usual, by the difference of weight of the inner and outer papers. This residuum is cleared off into a platina capsule with a tooth brush, and digested in a dilute solution of potash, at a boiling temperature. Three parts of potash are fully sufficient to dissolve out one of sulphur. When the above solution is thrown on a filter, and washed first with a very dilute solution of potash, boiling hot, then with boiling water, and afterwards dried, the carbon will remain; the weight of which, deducted from that of the mixed powder, will show the amount of sulphur.

I have tried many other modes of estimating the sulphur in gunpowder more directly, but with little satisfaction in the results. When a platina capsule, containing gunpowder spread on its bottom, is floated in oil, heated to 400° Faht. a brisk exhalation of sulphur fumes rises, but at the end of several hours, the loss does not amount to more than half the sulphur present.

The mixed residuum of charcoal and sulphur, digested in hot oil of turpentine, gives up the sulphur readily, but to separate again the last portions of the oil from the charcoal or sulphur is hardly possible.

When gunpowder is digested with chlorate of potash and dilute muriatic acid, at a moderate heat, in a retort, the sulphur is acidified; but this process is disagreeable and slow, and consumes much chlorate. The resulting sulphuric acid, being tested by nitrate of baryta,

indicates, of course, the quantity of sulphur in the gunpowder. A curious fact occurred to me in this experiment:—After the sulphur and charcoal of the gunpowder had been quite acidified, I poured some solution of the baryta salt into the mixture, but no cloud of sulphate ensued. On evaporating to dryness, however, and redissolving, the nitrate of baryta became effective, and enabled me to estimate the sulphuric acid generated, which was, of course, ten for every four of sulphur.

The acidification of the sulphur, by nitric or nitromuriatic acid, is likewise a slow and unpleasant operation.

By digesting gunpowder with potash water, so as to convert its sulphur into a sulphuret, mixing this with nitre in great excess, drying and igniting, I had hoped to convert the sulphur readily into sulphuric acid; but on treating the fused mass with dilute nitric acid, more or less *sulphurous* acid was exhaled; this occurred, even though chlorate of potash had been mixed with the nitre to aid the oxigenation.

The following are the results of my analysis, conducted by the first described method:—

100 grains afford, of	Nitre.	Charcoal.	Sulphur.	Water.	
Waltham Abbey	74.5	14.4	10.0	1.1	
Hall, Dartford	76.2	14.0	9.0	0.5	loss 0.3
Pigou and Wilks	77.4	13.5	8.5	0.6	
Curtis and Harvey	76.7	12.5	9.0	1.1	loss 0.7
Battle gunpowder	77.0	13.5	8.0	0.8	loss 0.7

It is probable, for reasons already assigned, that the proportions mixed by the manufacturers may differ slightly from the above.

The English sporting gunpowders have long been an object of desire and emulation in France: their great superiority for fowling-pieces, over the product of the French national manufactories, is indisputable: unwilling to ascribe this superiority to any genuine cause, M. Vergnaud, Captain of French artillery, in a little work on fulminating powders, lately published, asserts *positively*, that the English manufacturers of "poudre de chasse" are guilty of the "chalatanisme" of mixing fulminating mercury with it. To determine what truth was in this allegation, with regard at least to the above five celebrated gunpowders, I made the following experiments:—

One grain of fulminating mercury, in crystalline particles, was mixed in water with 200 grains of the Waltham Abbey gunpowder, and the mixture was digested over a lamp, with a very little muriatic acid. The filtered liquid gave manifest indications of the corrosive sublimate, into which fulminating mercury is instantly convertible by muriatic acid, for copper was quicksilvered by it—potash caused a white cloud in it, that became yellow, and sulphuretted hydrogen gas separated a dirty yellow white precipitate of bisulphuret of mercury. When the Waltham Abbey powder was treated alone with dilute muriatic acid, no effect whatever was produced on the filtered liquid by the sulphuretted hydrogen gas.

Two hundred grains of each of the above sporting gunpowders were treated precisely in the same way, but no trace of mercury was

obtained by the severest tests. Since, by this process, there is no doubt but one 10-1000th part of fulminating mercury could be detected, we may conclude, that Captain Vergnaud's charge is groundless. The superiority of our sporting gunpowders is due to the same cause as the superiority of our cotton fabrics; the care of our manufacturers in selecting the best materials, and their skill in combining them.

7. *On Detonating Matches.*

This subject has been so ably treated in the report of MM. Aubert, Pellissier, and Gay Lussac, that I shall confine myself to a few observations, the results chiefly of my own experience.

Mr. Howard's proportions of the ingredients for preparing his fulminate of mercury, are—

Mercury, - - - - - - - - -	100 grains.
Nitric acid, sp. gr. 1.3, $1\frac{1}{2}$ measured ounces -	= 884
Strong alcohol, 2 measured ounces, - - -	= 750

The mercury is dissolved by heat in the acid—the solution is allowed to cool to a blood heat, and then poured into the alcohol. On heating the mixture slightly, an effervescence soon ensues, the commencement of which is the signal for removing the heat from the matrass or retort, for if it be continued for some time longer, the chemical action will become furious, and the fulminate will be injured by an admixture of subnitrate of mercury. After the crystalline powder precipitates, the whole is to be thrown on a filter, washed, and dried on a steam bath.

The authors of the above report say, the best proportions are those of Howard, but they appear to estimate them incorrectly, for they prescribe twelve of nitric acid and twelve of alcohol, (by weight,) to one of mercury; we may hence infer, that considerable latitude may be used in the proportions of the materials. I consider the latter ones wasteful, since 100 of mercury, with 950 of nitric acid, 1.35 and 850 alcohol 0.835, produce about 120 parts of a perfect fulminate. The supernatant liquid retains nearly five per cent. of the mercury, for five grains of a dark gray oxide may be obtained from it by ammonia.

I have analyzed the match powder collected from fifty detonating caps of French manufacture, taken from a stock found to answer very well in practice. The whole weighed exactly 16.3 grains, being about one-third of a grain per cap. Treated with hot water, it yielded 8.5 grains of soluble matter, of which 7.0 grains were nitre, and 1.5 nitrate of mercury, derived from the ill made fulminate. By boiling again in water, this passed into a yellow subnitrate.

7.2 grains of insoluble matter were brushed off the dried filter, and heated with dilute muriatic acid. The solution being thrown on a filter, this retained one grain of carbon and sulphur, while 6.2 grains of fulminate of mercury passed through in the state of a bichloride. The proportions of this match powder must have been, therefore, eight grains of a kind of gunpowder, and about eight of

indifferent fulminate of mercury, and yet it exploded very well; it obviously contained more nitre than usually enters into gunpowder.

The proportions deduced by the French commissioners, from their elaborate and able researches, are ten of fulminate and six of pulverin, (gunpowder meal.)

One hundred grains of fulminate, triturated with a wooden mullar on marble, with thirty grains of water and sixty of gunpowder, are sufficient to mount four hundred detonating caps.

In describing the formation of fulminating mercury, I omitted a curious fact that lately occurred to me. Desirous of moderating the reaction of the mixture which had been overheated, I added a little alcohol from time to time, till its quantity was increased by nearly one-half. The fulminate being washed, and laid out on the filtering paper in the air, when nearly dry, minute brilliant points were observed to start up on different parts of its surface, which becoming larger, were found to be globules of mercury: this metallization went silently and slowly on till nearly one-half of the powder disappeared: an ethereous hydrocarbonate was evidently the agent in this unexpected reduction. [*Journ. Royal Institution.*

REPORT ON MR. BABBAGE'S CALCULATING ENGINE.

Report of the Committee appointed by the Council of the Royal Society, to consider the subject referred to in Mr. Stewart's Letter, relative to Mr. Babbage's Calculating Engine, and to report thereupon.

Your committee, in this their report, have no intention of entering into any consideration of the abstract mathematical principle on which the practicability of such a machine as Mr. Babbage's relies, nor of its public utility when completed. They consider the former as not only sufficiently clear in itself, but as already admitted and acted on by the council in their former proceedings. The latter they regard as obvious to every one who considers the immense advantage of accurate numerical tables in all matters of calculation, especially in those which relate to astronomy and navigation, and the great variety and extent of those which it is professedly the object, and within the compass of Mr. Babbage's engine to calculate, and print with perfect accuracy.

The original object of the present machine was to compute any tables which could be calculated by six orders of differences, and twelve figures in each, and sixteen figures in the table itself, in such a form that, by bestowing a very moderate degree of attention to their publication, it would be impossible for a single figure to be erroneous; and supposing any person employing them to entertain a doubt whether that moderate degree of care had been bestowed, he might in a short time himself verify the tables. The machine was intended to produce the work stamped on plates of copper, or other proper material.

Besides the cheapness and celerity of calculation to be expected from it, the absolute accuracy of the printed results being one of the prominent pretensions of Mr. Babbage's undertaking, the attention of your committee has been especially directed, both by careful examination of the work already executed, and of the drawings, and by repeated conferences with Mr. Babbage to this point. And the result of their inquiry, is, that such precautions appear to have been taken in every part of the contrivance and work which they have examined, and so fully aware does the inventor appear to be of every circumstance which may by possibility introduce error, that they have no hesitation in saying they believe these precautions effectual, and that whatever the engine does it will do truly.

In the actual execution of the work they find that Mr. Babbage has made a progress, which, considering the very great difficulties to be overcome in an undertaking so novel, they regard as fully equalling any expectations that could reasonably have been formed: and that although several years have now elapsed since the first commencement, yet that when the necessity of constructing plans, sections, elevations, and working drawings of every part; that of constructing, and in many cases inventing, tools and machinery of great expense and complexity, (and in many instances of ingenious contrivances, and likely to prove useful for other purposes hereafter,) for forming with the requisite precision parts of the apparatus dissimilar to any used in ordinary mechanical works; that of making many previous trials to ascertain the validity of proposed movements; and that of altering, improving, and simplifying those already contrived and reduced to drawings; your committee are so far from being surprised at the time it has occupied to bring it to its present state, that they feel more disposed to wonder it has been possible to accomplish so much.

The drawings form a large and most essential part of the work; they are executed with extraordinary care and precision, and may be regarded as among the best that have ever been constructed. On these all the contrivance has been bestowed, and all the alterations made, so that scarcely any work excepting drawing has been thrown away. When it is mentioned that upwards of 400 square feet of surface are covered with drawings, many of them of the most elaborate description, it will easily be understood that a very great expense of time, thought, and capital, must have been incurred in producing them, but without which your committee consider that success would have been impossible.

Nearly the whole of this department of the work, (according to Mr. Babbage's statements, probably nine-tenths,) is completed, and what remains is of a nature to afford no difficulty on the score of contrivance; so that there is no reason why the execution of the work, (hitherto necessarily retarded till the completion of the drawings,) could not now proceed with rapidity; and according to what the committee have been enabled to gather from Mr. Babbage's statements and their own observations, and supposing no unexpected

cause of delay, they regard a further period of three years as probably sufficient for its completion.

In judging of the adequacy of Mr. Babbage's work to complete the objects for which it was intended, there are two distinct questions—the adequacy of the contrivance, and that of the execution. On the former point every explanation has been afforded by Mr. Babbage, and both the drawings and the work executed have been unreservedly subjected to their discussion, and have been such as to excite a well grounded confidence. The movements are combined with all the skill and system which the most experienced workmanship could suggest.

But in so complex a work, in which interrupted motions are propagated simultaneously along a great variety of trains of mechanism, it might be apprehended that obstacles would occur, or even incompatibilities arise, from the impracticability of foreseeing all the possible combinations of the parts, and of which, on a mere inspection, your committee could not be expected to form a judgment. But this doubt, should it arise, your committee consider as fully and satisfactorily removed by the constant employment by Mr. Babbage of a system of mechanical notation, devised by himself, and explained in a paper in the Transactions of this Society; which places at every instant the progress of motion through all parts of this or any other mechanism distinctly in view, and, by an exact tabulation of the times required for all the movements, renders it easy to avoid all danger of two contradictory impulses arriving at the same instant at any part.

Of the adequacy of the machinery to work under all the friction and strain to which it can ever be fairly exposed, and of its durability, your committee have not the least doubt. Great precautions are taken to prevent the wear of the parts by friction; and the strength, solidity, and equilibrium, in the whole apparatus, ensure it from all danger on the score of violence or constant wear.

It ought also constantly to be borne in mind, that in all those parts of the machine where the nicest precision is required, the wheel work only brings them by a first approximation, (though a very nice one,) to their destined places; they are then settled into accurate adjustment by peculiar contrivances, which admit of no shake or latitude of any kind.

The machine consists essentially of two parts, a calculating part and a printing part. These are both equally essential to the fulfilment of Mr. Babbage's views; for the whole advantage would be lost, if the computations made by the machine were copied off by human hands and transferred to type by the usual process. The actual work of the calculating part is in great measure constructed, although not put together, a portion only having been temporarily fitted up for the inspection of the committee; and from its admirable workmanship they have been able to form a confident opinion that it will execute the work expected from it. At the same time, the committee cannot but observe that, had inferior workmanship been resorted to, such is the number and complexity of the parts,

and such the manner in which they are fitted together, the success of the undertaking would have been hazarded; and they regard as extremely judicious, although, of course, very expensive, Mr. Babbage's determination to admit of nothing but the very best and most finished work in every part; a contrary course would have been false economy, and might have led to the loss of the whole capital expended on it.

In the printing part less progress has been made in actual execution than in the calculating. The reason being the greater difficulty of its contrivance, not for transferring the computations from the calculating part to the copper, or other plate ultimately destined to receive them, but for giving to the plate itself the number and variety of movements which the forms adopted in printed tables may call for in practice. The movements necessary for effecting this, being entirely such as might at any time be decided on, were purposely allowed to stand over till the more difficult parts should be fully developed. Taking the calculating and the printing part together, and regarding the tools and machinery already erected as available for the performance of what remains, the committee regard it as not improbable that three-fifths of the work may be already completed, but they cannot be expected to state this with any degree of certainty.

With regard to the expense incurred, and likely to be incurred, Mr. Babbage states the sum already expended by him at £6000; £1000 of which he states to have been laid out in preliminary trials, which have not formed an object of inquiry with the committee. Taking into consideration the extent of the work and drawings, which they have examined, and judging entirely from the general knowledge of the cost of these and similar works, which the professional experience of several individuals of the committee has enabled them to acquire, they are no way surprised at the outlay thus stated to have been incurred. With regard to the future cost, they have, of course, less means of judging than of the past,—of which they see the results, and the tools with which they have been produced. A probable conjecture might be grounded on the proportion of $\frac{3}{5}$, assumed as the proportion of the work already done; but this would require to be received with very great latitude.

Finally, taking into consideration all that has been already said, and relying not less on the talent and skill displayed by Mr. Babbage as a mechanician, in the prosecution of this arduous undertaking, for what remains,—than on the matured and digested plan and admirable execution of what is accomplished, your committee have no hesitation in giving it as their opinion, that "in the present state of Mr. Babbage's engine, they do regard it as likely to fulfil the expectations entertained of it by its inventor."

(Signed,) I. F. W. Herschel.
Chairman.

New System of Water Power.

A DESCRIPTION and plans of a mode of supplying public works with water as a moving power in all situations, and at all seasons of the year, have been introduced lately into Scotland, by an engineer of the name of Thom, which promises to be of the greatest advantage to this country, not only as offering a cheap substitute for steam power, but as lending a powerful aid to the amelioration of the condition of the working classes, and perhaps of becoming the means of removing the intolerable nuisance of smoke in large towns. This plan of water power which has been adopted at Grenock on a beautiful water fall of 512 feet high above the level of the sea, is capable of universal application throughout the island, and is rendered complete by the contrivance of a series of self-acting sluices adapted to every site and state of the weather, all the invention of the engineer who had the honour of first submitting the plan to the public. The success of the method at Rothsay, in the Isle of Bute, where it originated, induced a company of patriotic gentlemen in Grenock to lend themselves to the undertaking, and their works now, nearly finished, form one of the greatest wonders of art in the country. The rains collected from a number of barren hills in the neighbourhood of Grenock, are collected into a large natural reservoir at their base, and conveyed along the face of mountains, carried across deep ravines, and conducted along the edge of rocky precipices, in a gently sloping aqueduct about six miles long, to the brow of a hill surmounting the town; thence the water is led along in small aqueducts or lades to the mills, which are situated on the face of the hill, amounting to thirty-three in number, and from their various heights, being placed necessarily below each other, yielding a power arising from the extent of their falls equal to that of 2000 horses, as appears by the report of the company's engineer; and if certain improvements be afterwards made, they may be made to yield a power equal to that of 3000 horses, a mechanical power, far exceeding that of the great manufacturing town of Glasgow, and populous vicinity. The water collected into the great natural reservoir with some auxiliaries is drained from about 4890 acres of ground; it covers about 300 acres, in which the water stands about 46 feet deep, and it is capable of containing about 300 millions of cubic feet of water, or of discharging 600 millions of cubic feet annually; so that besides supplying the town of Grenock amply with water for culinary purposes to the amount of 50 millions of cubic feet annually, the reservoir can furnish 2464 cubic feet of water for 310 days, (the working days,) in the year; for the period of 12 hours a day. The most astonishing circumstance regarding this immense public undertaking, is, that they can afford to give their water so cheap to the people who take their mills, that the price of a horse's power is reduced to about the 20th part of what it would cost were it derived from steam. The expense of steam engines and fuel would, by the general adoption of this plan throughout the country, be entirely done away with. Coals, and many articles of consumption, would be rendered cheap-

er; the smoke of public works would be abolished in a more effectual way than by burning; and the health and morals of the lower classes, the last, but not the least important of the advantages, to be derived from it, would be improved by the removal of manufactories from confined situations in crowded towns, to airy and salubrious situations in the country. [*New Monthly Magazine, for* 1829.

Effect of Iodine upon Germination.

A SERIES of comparative experiments have been made by M. Canter, upon the germination and vegetation of plants moistened with water, solution of chlorine, and solution of iodine, the latter of equal density. The following are his conclusions: 1st, iodine is generally more effectual than chlorine in facilitating the germination of seeds; 2nd, iodine produces this effect by stimulating the germen of the seeds in the same manner as oxygen and chlorine; 3d, iodine is absorbed by the growing plant, but, by its affinity for hydrogen and the power of vegetation, is soon converted into hydriodic acid; 4th, the germination of seeds, which appear to have lost all vital powers, may frequently be excited by iodine. [*Bull. Univ.*

The Distance accomplished within one hour on the Liverpool and Manchester Rail-way.

IT has often been a subject of doubt whether the distance from Liverpool to Manchester could be travelled by a locomotive engine in the space of one hour. This extraordinary feat was performed on Tuesday morning, (Nov. 23,) by the Planet, one of Mr. Stephenson's most approved engines—the time occupied being only 60 minutes, of which two minutes were taken up in oiling and examining the machinery about midway. There were no carriages attached to the engine; the only persons on the tender being the engineer, the fireman, and Mr. Williams, the principal clerk in the Liverpool Crown street station. [*Manchester Mercury.*

Preservation of Iron from Rust.

A MASTIC or covering for this purpose, proposed by M. Zeni, and sanctioned by the Societé d'Encouragement, is as follows: eighty parts of pounded brick, passed through a silk sieve, are mixed with 20 parts of litharge; the whole is then rubbed up by the mullar with linseed oil so as to form a thick paint, which may be diluted with spirits of turpentine; before it is applied the iron should be well cleaned.

From an experience of two years, upon locks exposed to the air, and watered daily with salt water, after being covered with two coats of this mastic, the good effects of it have been thoroughly proved. [*Bull. d'Encour.*

To Readers and Correspondents.

The Committee on Publications, anxious to render this work as valuable as possible, have determined to offer a liberal compensation for original articles on the subjects to which this journal is devoted; and they accordingly invite men of science and mechanics to communicate their observations. Every article published will be liberally paid for.

All communications must be addressed, *free of expense*, to *Wm. Hamilton, Actuary of the Franklin Institute, Philadelphia.*

Meteorological observations for February, 1831.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2, P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain and snow.	State of the weather, and Remarks.	
				Inches	Inches.			Inches.		
	1	31°	34°	29.30	29.40	W. N. W.	Blustering.		Cloudy.	Thawing.
	2	29	38	.90	30.00	W. W.	Moderate.		Clear.	Flying Cl'ds.
	3	26	32	30.00	29.70	S. E. S. E.	do.	.90	Cloudy.	Snow.
☾	4	25	24	29.40	.95	W. W.	Blustering.		Clear.	Clear.
	5	10	20	.65	.75	do.	do.		Clear.	Flying Cl'ds.
	6	8	20	.95	30.00	do.	do.		Clear.	Clear.
	7	13	24	30.05	.05	do.	Calm.		Cloudy.	Cloudy.
	8	15	30	29.95	29.95	do.	do.		Clear.	Cloudy.
	9	16	20	.95	.95	do.	Blustering.		Clear.	Clear.
	10	9	22	30.00	30.00	do.	Moderate.		Clear.	Clear.
	11	12	34	29.82	29.75	do.	do.		Clear.	Clear.
⊗	12	19	24	30.00	30.00	do.	do.		Flying cl'ds.	Sun eclipsed.
	13	12	20	30.00	.35	do.	do.		Clear.	Clear.
	14	6	22	.60	.60	do.	do.		Clear.	Clear.
	15	10	37	39.65	29.95	N. W. S.	do.		Clear.	Cloudy.
	16	40	46	11.95	.74	S. W.	do.	1.02	Rain.	Cloudy.
	17	34	36	.65	.75	W. W.	Blustering.		Clear.	Clear.
	18	15	24	30.10	30.10	do.	do.		Clear.	Clear.
☽	19	30	44	30.00	29.70	S. W. W.	Moderate.		Clear.	Clear.
	20	33	32	29.90	.30	N. W. W.	do.		Clear.	Clear.
	21	15	28	30.44	30.44	S. E. S.	do.		Clear.	Clear
	22	22	34	.15	.15	do.	Calm.		Cloudy.	Rain.
	23	42	40	29.30	29.30	S. S. W.	Moderate.	1.00	Rain.	Rain.
	24	27	31	.73	.83	W. N. W.	Blustering.		Clear.	Clear.
	25	21	30	.93	.90	N. W.	do.		Clear.	Clear.
○	26	24	37	30.05	30.10	W. W.	Moderate.		Clear.	Clear.
	27	27	42	.10	.15	W. E.	do.		Clear.	Clear.
	28	30	46	.15	.15	E. S.	do.		Clear.	Clear.
	Mean	21.46	31.11	29.91	29.97			2.92		

		Thermometer.		Barometer.	
Maximum height during the month,		46.	on the 16th and 28th,	30.60	on the 14th.
Minimum	do.	6.	on the 14th,	29.30	on the 1st, 20th, and 23d.
Mean	do.	26.28		29.94	

Water fallen in snow and rain, 2.92 inches.

Note.—During the solar eclipse the Thermometer in the shade fell 2 degrees. A meteorological register kept at Springfield, Clark county, Ohio, about lat. 39° 57′ N. and communicated to us, gives 17.66 for the mean temperature of the month of January at sun rise, which is nearly $3\frac{1}{2}$ degrees lower than the mean at sun rise as given in our table for January.

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MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

APRIL, 1831.

Safety Apparatus for Steam Boats, being a combination of the Fusible Metal Disk with the common Safety Valve. By A. D. Bache, Professor of Natural Philosophy and Chemistry in the University of Pennsylvania.

Among the causes which produce the explosions of steam boilers, no one stands more prominent, whether we have regard to the frequency of the explosions caused by it, or to their violence when they occur, than a defective supply of water within a boiler when in action. When the supply of water afforded to a boiler, is insufficient to compensate for the water which is converted into steam, the level of the fluid within is lowered; the boiler itself becomes heated, often intensely, and the steam partakes of this temperature without, from an insufficient supply of moisture to give the density corresponding to that temperature, having a corresponding elastic force. Of the existence of such a state of things within a boiler, the ordinary *safety valve* gives no indication, the tension of the steam within is not sufficient to overcome the weight with which the valve is loaded; it not only ceases to deserve the name of *safety* valve, but the opening of it, by hand, may be the very means of producing an explosion: for the escape of steam, thus permitted, relieves the water within the boiler from pressure; the fluid rises in foam; and being thrown into contact with the heated sides of the boiler, (or, as is supposed by some, being projected into the hot and unsaturated steam,) is flashed into steam, too considerable in quantity to find a vent through the valve, and of an elastic force sufficient to defy the controlling

power of the materials used in the construction of the boiler. The raising of this valve is not necessary to the production of an explosion in the circumstances supposed, a supply of water suddenly introduced will produce the same dreadful effect. That such circumstances have frequently occurred, and have as frequently caused the results above described, is fully shown by the various authentic accounts of explosions on record.

The memoir of M. Arago, a translation of which is contained in the Journal of the Franklin Institute,* furnishes proofs of this fact; and the explosion of the boiler of the Chief Justice Marshall, during the last summer, has, I conceive, been fairly referred to the occurrence of similar circumstances.

The French Academy, when called upon, in 1823, to report to their government, the precautions to be used to prevent the explosions of steam boilers, satisfied of the insufficiency of the common valve to insure safety, required that in addition to two safety valves of the ordinary construction, one at the disposal of the engineer, the other under lock and key, there should be two plates of fusible metal covering apertures in the boiler; the one having its melting point at 18° F. above the temperature of the steam, which, according to the statement of the proprietor, made when his engine was established, was required to be used in the engine, the other at 18° above the fusing point of the first: the fusing point of each is thus, even in a high pressure engine, much below the temperature to which the boiler being heated there would be danger of explosion.† Now whether the steam be very elastic or not, so soon as it, or the boiler, arrives at the temperature requisite to fuse these plates, they melt, and the steam is discharged; this, too, below the limit of temperature at which such a discharge of steam would, according to the statement made in the former part of this article, be attended with danger.

These plates are made of alloys of bismuth, tin, and lead, in proportions varied according to the temperatures at which they are required to melt; by covering each with a piece of fine wire-gauze, it is prevented from swelling out by the effect of softening as it verges towards the fusing point.

Experience has shown that these plates can be relied on, confidently, to answer the ends proposed. In the stationary engine we should thus, by borrowing from our brethren abroad, be provided with a certain remedy against explosions caused by the circumstances we have endeavoured to explain, and also against the bursting of the boiler from an accumulation of steam within, should any accidental derangement of the common safety valve prevent its action. This device would be of the greatest value if applicable to steam boat boilers, for, being entirely without the control of the engineer, caution would be produced by the fact that any attempt to

* Vol. v. No. 6, and vol. vi. No. 1, 1830.

† Iron at a dull red heat has a temperature of 947° F. while steam of eleven atmospheres corresponds according to the late determination of Arago and Dulong to a temperature of 367.34° F.

raise the steam above the proper pressure, or any inattention to the supply of water within the boiler, would be immediately made known to the captain and passengers by the noisy efflux of steam through the aperture opened by the melting of this tell-tale plate. If the plate were placed within sight of the passengers, the only means of an improper kind, to which the engineer could resort, to prevent its fusion, (sometimes practised in the stationary engine in France, according to M. Arago,) viz. keeping it cool by the application of water to its surface, would be entirely cut off.

The reason why this plate has been considered inapplicable to steam boat boilers, in general, is obvious; when the plate melts, all the steam must escape from the boiler, and the apparatus must cool before it can be replaced by a similar plate; this sudden desertion of the prime mover of the engine might, in certain cases, put the lives of the passengers in almost as great jeopardy as an explosion; instances, in an exposed navigation, will readily occur on reflection, such as a boat on a lee-shore, &c. In all cases such a desertion would be attended with very great inconvenience.

The remedy for this, and one which simplicity and consequent ease of application seem to recommend very particularly, will now be stated. If, as is hoped, this apparatus shall be found to remove every objection to the use of the fusible plate in the boilers of steam boats, it will insure the exemption of passengers from a portion at least of the dangers to which they are now so often exposed.

The method, which I would propose, is to combine the fusible plate, with the ordinary safety valve. Such a plate affixed to an opening of a proper size, in the boiler, as near as may be practicable to the highest line which is exposed to the direct action of the fire, is covered with a hollow cylinder, of a greater diameter than the aperture covered by the plate, the base of which presses upon the edges of the plate, while the top is arranged as the seat for a conical, or flat valve, of the ordinary kind; this valve will be habitually open, and when required to be used to prevent the escape of all the steam, will be pressed down, as is usual, by a weight acting by the intervention of a lever. This apparatus should be so placed upon the boiler as to be seen by the passengers, who are thus enabled to know that all is right, while the lever attached to the valve is in an elevated position, showing that the valve is raised from its seat; this lever is kept in its raised position, by a cross bar, supported on uprights, to which it is attached by a strong chain fastened by a padlock; the key of this lock being in the possession of the captain of the boat, the chain cannot be slipped, and of course the lever cannot be lowered, to close the valve, except through his agency. Suppose the steam or the boiler to become heated to the fusing point of the plate; it melts, steam issues through the small cylinder covering the plate, with a noise, which even at night would arouse the captain and passengers; if no danger will be incurred by loss of steam, and the consequent stoppage of the engine, such an escape should be allowed as a mea-

sure of precaution, though it is by no means one of necessity, since the limit of temperature producing fusion is much below that required for explosion. The alarm given, the steam gauge, should derangement of the safety valve have prevented its action, or, the usual practical observation upon the issuing steam, will show whether the fusion of the plate was caused by an accumulation of steam, or by the defective supply of water; this may be further tested by the gauge cock; should it prove that the water is below the usual level, a supply can be introduced without danger. A second plate, arranged in a similar manner to the first, fusible at say 20° F. above this, should be also provided, that the same means of safety may remain in case of accident to the first plate. The vigilance of the engineer would almost be insured by the use of these plates, from a knowledge that his inattention could not escape detection and its consequences. Passengers would be guarded against the results of carelessness, should it exist, and captains, as well as the public, would have the means of knowing accurately the value of those employed in the responsible station of engineers. The want of patronage which would inevitably attend an ill regulated engine, would soon correct evils now so formidable.

By the annexed figures, the method of arranging the fusible plate and safety valve, is shown in detail.

Fig. 1.

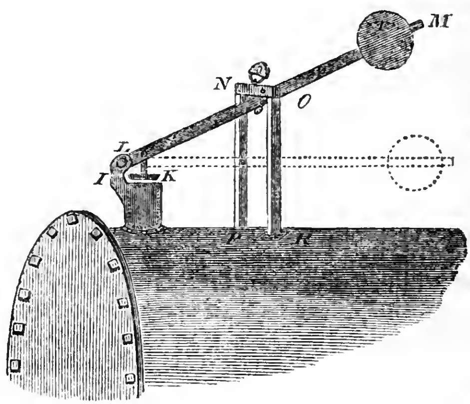
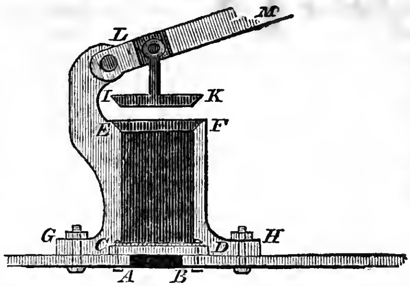


Fig. 1, represents an oblique view of part of a boiler with the safety apparatus attached. An unfavourable case, as to the space occupied by the apparatus, is taken, namely, that of a high pressure boiler required to work with steam of 150 lbs. bursting pressure, (ten atmospheres,) rendering it necessary to load the valve with rather more than 150 pounds.

Fig. 2, gives more in detail the method of arranging the fusible plate, &c. being a section of the apparatus. The area of the aperture closed by the plate is taken at 3 square inches, which is one half more than the area of the safety valve commonly used in a high

Fig. 2.



pressure boiler of 3 feet in diameter by 10 feet in length. A, B, Fig. 2. is the aperture closed by the plate, C, D, of fusible metal, covered by a piece of wire gauze to prevent the plate from yielding as the temperature approaches its point of fusion. The plate is surrounded by a cylinder, E, F, G, H, of a greater diameter than the plate, terminated, above, by the valve seat E, F. Should the fusible plate, in giving vent to the steam, be thrown upwards, as an expression used by Arago in relation to it, gives reason to suppose, the valve should not be in the cylinder, E, F, G, H, but in one at right angles to it, so that the valve seat should not be vertically over the fusible plate. The valve, I, K, is represented of the usual form, though it may be questioned, whether this is the best which can be given: it is drawn in the position which it should habitually have, that is, so far raised from the seat as to give an opening for the escape of steam, equal in area to the valve.

To retain the valve in its position, the lever L, M, Fig. 1, is fastened to a bar of iron, N, O, (supported by the uprights N, P, and O, R, of the same material) by a chain, which is attached to N, O, at one extremity, and which passing round the lever, returns through an opening in N, O, to the top of the bar, where it is secured by a padlock. In the drawing the area of the valve, I, K, is $4\frac{1}{2}$ square inches; this, at 150 lbs. to the square inch, requires a weight of 675 lbs. to press it down. The short arm of the lever is $1\frac{1}{2}$ inch, the long arm 30 inches, the weight, T, is then about 33 lbs.

To raise the valve sufficiently above its seat, requires in the case figured, stanchions of 12.4 inches high. The whole apparatus thus occupies less than 3 feet in length, and 18 inches in height. The dotted lines represent the position of the valve when, after the fusion of the plate, it may have been closed.

On the importance of Hygrometric Observations in Meteorology, and the means of making them with accuracy.

The importance of hygrometric observations as forming a part of a meteorological journal, especially since we are now furnished with a hygrometer, which will inform us with certainty, not only of the relative quantity of vapour in the atmosphere, but of the absolute quantity, has induced me to offer a few remarks on this subject to the members of the Franklin Institute, for their consideration.

The object I have in view is to induce the Institute to use their

influence to have meteorological journals kept in different parts of our wide extended country, on the same plan, and published in the Journal of the Institute monthly. Many persons, for their own private gratification, are now keeping very imperfect meteorological journals, who would feel a tenfold interest in the subject if they were informed by the Institute how to keep a much more perfect journal, with no more trouble, and at the same time contribute greatly to the public good. As many persons in the country may be willing, at the suggestion of the Institute, to keep a journal, who are not furnished with a Daniell's or Jones' Hygrometer, it may be useful to know how its place may be supplied. Any contrivance to obtain water in a common tumbler, cold enough to cause moisture to settle on the outside, will answer the purpose. During the summer months I have generally found pump water sufficiently cold, and in other months I have used ice or snow, and in very cold weather I have been obliged to have recourse to salt and snow. Any of these methods I consider preferable, both in simplicity and accuracy, to Daniell's or Jones', for by mingling waters of different temperatures, one above, and the other below the dew point, the exact point may be obtained to great nicety in a short time—whereas in using the evaporation of ether, the temperature is suddenly depressed below the dew point, sometimes to a considerable distance, and it requires much more time and skill to arrive at even tolerable accuracy.

However, when I could not procure ice or snow, I attached a small piece of muslin, or a thin piece of sponge, to one side of the bulb of a common thermometer, and poured a small quantity of ether upon it, carefully watching the naked side to see when the dew began to settle on it. When it settled very rapidly the thermometer had sunk below the dew point—but by wiping off the dew, and letting it settle again repeatedly, I could obtain a pretty accurate result. I have frequently compared these results with those I obtained by means of the cold water in the tumbler, and the agreement was very satisfactory.

In taking the temperature of the air, also, great care is required or errors will be committed. If the thermometer is surrounded by bodies either hotter or colder than the air, it will be affected by radiation—in the former case, it will give a temperature too high; in the latter, too low. In a clear calm evening, after sun set, I have known a thermometer placed near the ground and exposed to the open sky, to indicate from 8 to 12 degrees below the temperature of the air, which may be obtained nearly by swinging the thermometer rapidly round. So, during the day, if it is exposed to bodies heated by the sun, it will sometimes be several degrees warmer than the surrounding atmosphere which is not heated by radiation, but only by contact with solid bodies.

In cloudy weather, however, no such effects take place, for then the surface of the earth, and all other solid bodies, have their radiated caloric returned by the clouds, and consequently, they retain the temperature of the air. On cloudy nights the surface of the

earth does not cool below the *dew point;* and, therefore, there is no dew. Even in clear nights, when the dew point is very far below the temperature of the air in the day, the surface of the ground does not sink in temperature to the dew point by radiation, and in such case also no dew is formed. I have observed in August, when the dew point has been as high as 76° Fah. when the temperature of the air during the day was above 90°, that but little dew was formed during the night, in the city of Philadelphia. No doubt more was formed in the country, where the surface of the ground was not exposed to radiation from hot brick walls. Be that as it may, I never saw dew begin to form on the grass in my yard, until its temperature had sunk to the dew point. Indeed, no reason can be imagined why it should settle on the grass before it is cooled by radiation to the dew point, any more than on a tumbler of water above the dew point. The phenomena are the same. The dew does not, in either case, fall through the air; but the vapour which is in the air, equally diffused by its own elasticity, when it comes in contact with solid bodies, cooled by radiation or otherwise, below the dew point, is deprived of so much of its caloric, that it is no longer able to maintain its elastic state, and is precipitated in the form of dew.

An objection may be urged against this theory, which at first appears plausible. It is known that dew does not appear under a shed, or even under a covering of thin muslin spread out at the distance of some feet from the ground, and therefore it is inferred that dew falls through the air from the upper regions. The true reason, however, is, that the temperature of the grass, or other bodies under the cover, does not fall to the dew point, the radiations being returned by the cover, which may easily be ascertained by placing one thermometer under the cover where there is no dew forming, and another in the grass, beyond the cover, where the dew is forming, when the difference will be detected. I have seen a difference of 8 or 10 degrees under the protection of a silk handkerchief, even when the air had a free passage between it and the ground.

Hence is demonstrated the great utility of even thin coverings over tender plants during clear nights in the spring, when the surface of the ground is likely to be cooled by radiation down to the freezing point. Plants so protected may be preserved, while those in their neighbourhood, unprotected, will be entirely destroyed.

Another argument against the theory of dew here proposed is, that the lower parts of the atmosphere do not contain vapour enough to form such heavy dews as sometimes appear—when more vapour is precipitated than is contained in a hundred feet of the atmosphere, in height, and it cannot be presumed that all this air comes in contact with the surface of the earth during a calm night when the dew is the greatest.

But this objection will have no weight, when we recollect what Dalton, I believe, first demonstrated, that aqueous vapour is not supported by the air, but by itself. Or, in other words, if the air should be suddenly annihilated, the aqueous vapour which is now diffused through it by its own elasticity, would neither sink upon

itself, nor expand to a higher elevation; but its own elasticity would just be able to support its weight without further condensation. If now we suppose the lowest stratum of this vaporic atmosphere to be changed into dew, it is manifest that the whole vaporic atmosphere must descend; and this takes place, whether we suppose an atmosphere of common air or not: a longer time will be required to settle through the air than if there was none; but the ultimate effect is the same in both cases.

Indeed the hygrometer itself affords a most satisfactory proof, that aqueous vapour is not supported by atmospheric air; for it is no uncommon thing for the dew point to remain the same through the night—indicating that the density of the vapour continues unchanged; which could not be the case if vapour was supported by the air. For, as vapour is only about one-half the density of air, even when at its greatest density, unless compressed by art, it would rise rapidly through the air, from its levity, and leave the lower parts absolutely dry during the night, whilst no vapour is sent up from the ground to take the place of that which, by supposition, has ascended into the upper regions of the air. Surely it will not be said that vapour is sent up from the ground at the very moment dew is deposited there.

It must not, however, be supposed, that after vapour is condensed into cloud, it continues to press only upon the vapour below it. Part of its weight is then supported by the air, and the vapour below being relieved from part of its pressure, immediately upon the formation of the cloud, expands, and the dew point falls, as will be shown hereafter.

It is well known that the increase of aqueous vapour in the atmosphere, over a particular region, will depress the barometer, because this vapour is only about one-half the specific gravity of common air; but there are so many causes which produce a depression of the barometer, besides the rise of the dew point, or increase of moisture in the air, that a fall in the barometer is not an infallible sign of rain; yet I have no doubt that these two instruments united will enable the meteorologist to predict rain with absolute certainty, after a sufficient number of observations have been made to eliminate by induction a general law.

In the course of these observations, no doubt many curious facts will be discovered which the present state of science does not enable the philosopher to predict.

I will mention one here, which was so contrary to my anticipations at the time I first observed it, that for a while I doubted the possibility of ever arriving at any useful knowledge on the subject.

In the summer of 1829, there had been a very long period of dry weather, and I had been for many days taking the dew point very frequently, with much anxiety to discover the first indications of rain, when suddenly all my hopes were extinguished, by a fall in the dew point of several degrees in the course of half an hour—but to my great astonishment, in about 2½ hours, there came up one of the most violent showers I ever witnessed.

For several days previous to this, the barometer had been falling, and the dew point rising, (showing that the watery vapour was increasing,) whilst the temperature of the weather had remained nearly stationary.

I had been very particular in taking the dew point, so that I felt pretty confident no error was to be attributed to the observation; but still I was anxious to have an opportunity of witnessing a similar result.

Nothing similar was observed, though it might frequently have occurred, until the 16th of July, 1830, when I witnessed the following remarkable phenomenon. The weather had been very warm and dry for some days, the hygrometer being nearly stationary at 74°, for I had taken the dew point very frequently, and on the day of the present occurrence, I was sitting with the means of taking the dew point with me in my yard, when I perceived it suddenly sink 3 degrees, in a few minutes, and at the same time I observed a cloud forming immediately over my head, and in a few minutes more, the whole time not more than half an hour, a gentle shower of rain succeeded, hardly enough to wet the pavement.

Immediately after this shower the dew point rose again to its former elevation, 74°.

Not long after this I had the satisfaction of recording an observation of the same phenomenon, which renders it absolutely certain that sometimes, at least, the dew point sinks rapidly, and to a great extent, while it is raining in the neighbourhood.

From July the 16th to the 19th, the dew point gradually rose from 74° to 76°; it then remained stationary at that point, night and day, the mean temperature of the air being about 90° till the 22nd, at 5 o'clock, P. M. At 5, the dew point was 76°, as it had been for 4 days before; at 20 minutes after 5, the dew point was 70°; at 30 minutes after 5 it was 67°, and at 6 o'clock, it had fallen to 62°—that is, 14 degrees in one hour.

During all this time there was a great appearance of rain in the north—vivid lightning, thunder audible, and a strong wind blowing towards the cloud; and the temperature sunk 12 degrees. At 45 minutes after six, the wind had nearly ceased; but it did not begin to rain until 9, and rained but very little; but as I understood the next day, it had rained very hard between 5 and 6 within a few miles of the city—the barometer sunk $\frac{5}{100}$ of an inch, while the wind was blowing, but rose again when it became calm. The next morning the dew point had risen 9 degrees at 6 o'clock, and at 2, P. M. one degree more, being then within 4 degrees of its previous state.

It would not readily occur to any philosopher, á priori, that the dew point would fall just previous to the commencement of rain, or while it is raining in the neighbourhood; but after the fact is known, it is easily explained, on the principle first, I believe, demonstrated by Dalton, and afterwards discussed at large by Daniell—that aqueous vapour forms an atmosphere independent of the atmospheric air, and that these two fluids press only on particles of their own kind, and not on each other; consequently, as soon as it begins to rain over a small portion of country, as it often does in a summer

shower, the equilibrium of the vaporic atmosphere is disturbed, a partial vacuum of vapour is formed over the region where it is raining, and the vapour from surrounding regions rushes towards the cloud where the pressure is less, diminishing the tension of the vapour in the regions around the cloud, and thus lowering the dew point. How so rapid a depression of the thermometer took place, I am not prepared to explain, but the wind towards the cloud was no doubt produced by the impulse of the aqueous vapour against the particles of atmospheric air. The only objection occurring to me which can be brought against this explanation, is, that the wind is known to blow in all directions from a falling shower, just at the borders of the shower. But this does not invalidate the explanation given above; for this effect is produced by the pressure of the drops of rain, which may be considered as exerting their whole force of gravity on the air beneath them, as soon as they cease to accelerate in their descent towards the surface of the earth; but the wind thus produced is known to extend not far beyond the skirts of the shower, and, of course, at the distance of two or three miles it may yield to the more extensive influence of the cause assigned above.

My object, however, at present being not to assign causes for phenomena, but to induce the Institute to use their influence to cause them to be observed and recorded, I proceed to mention another subject which I hope will engage the particular attention of all those who may hereafter keep a meteorological journal. That is, the evaporating point. By the evaporating point I mean the point to which the thermometer will sink by being surrounded by wet paper.

I some time ago instituted a course of observations on this subject, constantly comparing the evaporating point with the dew point, principally with a view to ascertain if any law could be established, by which the dew point could be known by having the distance of the evaporating point below the temperature of the air. In the first part of these experiments I took it for granted, as stated by Mr. Leslie, that the evaporating point is the same whether the thermometer is at rest in still air, or moved with rapid motion; but I have ascertained, by not less than fifty observations, made with a view to decide this one point, that this is not the fact; for the thermometer, covered with wet paper, invariably stands lower when moved rapidly, than when permitted to remain at rest in still air; sometimes to the amount of four degrees, and this too when the surrounding solid substances are known to be of the same temperature as the air, so that the thermometer could not be affected by radiation. The reason assigned by Mr. Leslie is so plausible that nothing but experiment could have led me to suspect its fallacy. He says that the motion produces a more rapid evaporation, and, of course, more cold, yet the latter effect is exactly neutralized by the warm air coming in contact with the thermometer. I have not yet been able to ascertain the law desired; but that such a law exists, I have no doubt—and if it could be ascertained, the trouble of obtaining the dew point would be entirely avoided; for the evaporating point can always be obtained with as much ease as the temperature of the air. The simplest method which I have been able to think of, to obtain

the evaporating point, is to take an earthen pot unglazed, which I cause to be made for the purpose, and keep it filled with water, either where the air is still, as in a room, or where it is in motion, as you choose. The surface of the pot being constantly wet, the water within will always give you the evaporating point at any moment you may wish to make your observation. This much my observations will warrant me to say on this subject—that in high temperatures in summer, the evaporating point is nearer the dew point than the temperature of the air; and in low temperatures in winter, it is nearer the temperature of the air than to the dew point; consequently, there is some intermediate point where it stands half way between those two temperatures. Perhaps, also, the ratio may depend on the distance of the dew point from the temperature of the air. It would appear, that when the dew point is very far below the temperature of the air, the evaporating point recedes from the temperature of the air, and approaches the dew point.

By using the earthen pot to obtain the evaporating point, another very important inquiry may be answered without any other trouble than measuring the water used in replenishing the pot; i. e. how much water is evaporated from a humid surface in a given time?

Another subject which is at this moment exciting considerable interest among the philosophers of Europe, is, to ascertain the difference of temperature in the shade and in the sun, both with the bulb of the thermometer naked, and with one covered with black silk. Mr. Daniell thinks there is a much greater difference in high latitudes than in low. In Philadelphia, I have frequently found the naked thermometer rise forty degrees, and once fifty-six, above the temperature of the air, while the one covered with black was generally twelve degrees higher. Mr. Daniell also thinks that in high latitudes radiation after sun set cools the surface of the ground much more than in low latitudes. In this latitude, I have seldom found the temperature of the grass more than eight degrees below the temperature of the air. Whereas, Mr. Wells, who wrote the beautiful little essay on dew, says he has seen it as low as sixteen degrees below the temperature of the air. This would allow frost to occur in low situations when the temperature of the air during the night would not be below forty-seven degrees. Whereas, here, frost can hardly occur unless the temperature of the air falls below forty.

Capt. Scoresby mentions, as a strange and unaccountable phenomenon, that he has frequently observed, when sailing in high latitudes, the surface of the sea begin to be covered with thin ice, immediately after sunset, while the temperature of the air was still several degrees above the freezing point. When he called it unaccountable, he probably did not think of the principle of radiation. In Peru, where they have such heavy dews every night, the power of radiation must be very great, or, if not, the dew point must be but little below the temperature of the air during the day. Some traveller, I do not recollect his name, says he has seen frost in Africa in the torrid zone. Now I do not think this at all incredible. For the temperature in those regions must fall as far below the *mean* in the night, as it rises above the mean in the day. The mean tem-

perature of the torrid zone is about 84°, and as loose dry sand is a very bad conductor, and a very good absorber and radiater of caloric, the surface of those wide extended deserts of sand in calm weather may easily be conceived to become fifty or sixty degrees above the mean during the day, and fall as far below it during the night, which would bring it down to the freezing point.

If farmers were acquainted with this one principle of radiation, they would avoid many evils to which they are now exposed. Who would plant an orchard in a hollow, who knew that cold air accumulates in hollows at night by running down the slopes leading to it, in contact with the surface of the ground cooled by radiation?

The time of taking the hygrometric observations is not important; it is not so, however, with the barometer. This instrument has four diurnal fluctuations. Just before sunrise, when the air is the coldest, and about two o'clock, when the air is the warmest, and, of course, neither contracting nor expanding by change of temperature, the barometer stands at its mean height; but sometime between sunrise and the hottest part of the day, when the air is expanding most rapidly by increasing heat, the barometer will stand at its greatest diurnal elevation, and some time after the hottest part of the day, when the air is suffering the most rapid contraction from cooling, the barometer will stand at its greatest diurnal depression. In the torrid zone, the point of greatest elevation is found by observation to be between nine or ten, A. M. and that of greatest depression, between five and six, P. M.* Now as it would be very desirable that two observations should be taken every day, I would earnestly recommend that between nine and ten in the morning, and five and six in the afternoon, be the time of taking observations—and if any observer wishes to take a third observation, or if any should be unwilling to take more than one per day, let two o'clock, P. M. be the hour.

I have now mentioned the most important parts of a meteorological journal, none of which can be omitted without materially diminishing its utility.

Those observers who have self-registering thermometers, will of course note the greatest cold and greatest heat of each day. The course and strength of the wind must not be forgotten; and those who have the means will mention the quantity of rain each month—and those who have the porous earthen pot, will note the evaporation.

If what has been said should induce even one faithful observer to record the dew point alone for one year, I shall consider myself amply rewarded for my trouble in making this communication.

For the sake of those who may not have access to books, and who may be curious on this subject, I have copied from Turner's Chemistry the following table, from which it will appear what proportion of the atmosphere in weight is vapour when the dew point is at the different temperatures from 32 to 80. For example, when the dew point is at 32, the pressure of the vapour alone is $\frac{2}{10}$ of an inch of mercury—that is, $\frac{1}{150}$ of the whole if the barometer stands at 30

* For a full explanation of this diurnal variation, see this Journal, vol. 1.

inches. And if the dew point should rise to 80 degrees of Fah. which I believe it never does, for I have never seen it above 76; then would the pressure of the vapour alone be equal to one inch of mercury, that is, one-thirtieth of the whole atmospheric pressure.

Temperature of dew point.	Weight of vapour inches.	Temperature of dew point.	Weight of vapour inches.
32 - -	0.200	57 - -	474
33 - -	207	58 - -	490
34 - -	214	59 - -	507
35 - -	221	60 - -	524
36 - -	229	61 - -	542
37 - -	237	62 - -	560
38 - -	245	63 - -	578
39 - -	254	64 - -	597
40 - -	263	65 - -	616
41 - -	273	66 - -	636
42 - -	283	67 - -	655
43 - -	294	68 - -	676
44 - -	305	69 - -	698
45 - -	316	70 - -	721
46 - -	328	71 - -	745
47 - -	339	72 - -	770
48 - -	351	73 - -	796
49 - -	363	74 - -	823
50 - -	373	75 - -	854
51 - -	388	76 - -	880
52 - -	401	77 - -	910
53 - -	415	78 - -	940
54 - -	429	79 - -	971
55 - -	443	80 - -	1.000
56 - -	458		

A journal kept on the plan here recommended, during the month of April, will be given in the next number of this journal.

James P. Espy.

Philadelphia, March 31, 1831.

On the Strength of Pine and Spruce Timber.

A great portion of the annexed article, appeared in the last number of the American Journal of Science and Arts; it has been, at the request of the committee of publication, revised by the author. The note with which the article is now concluded, has been added, and the value of the table of results in page 232, increased by an extension of the calculations contained in the last column, and by the addition of some practical inferences drawn therefrom. [Com. Pub.

An account of some experiments made by order of Col. Totten, at Fort Adams, Newport, R. I., to ascertain the relative stiffness and strength of the following kinds of timber, viz: White Pine, *(Pinus strobus,)* Spruce, *(Abies nigra,)* and Southern Pine, *(Pinus australis,)* also called *(Long leaved Pine.*)—Communicated by* Lt. T. S. Brown, of the corps of Engineers.

The white pine and spruce were obtained from the eastern part of New England, and the southern pine from North Carolina. The specimens, which were well seasoned, were carefully selected, and were quite free from splits and knots. Three pieces of each kind of wood were taken, each piece being 9.389 feet in length, 2.75 inches in breadth, and 5.5 inches in depth. The distance between the points of support of the pieces under trial, was 7.1 feet. From one end of the beam, one point of support was 0.229 of a foot, or 2.75 inches distant, of course the other bearing point was 2.06 feet from the other end. All the above dimensions were chosen from their being proportional to those which will be actually required in the case to which these experiments refer. The load was applied by means of a strong platform, suspended from the beam, midway between the points of support. Bricks which had previously been accurately weighed, were used as weights. The deflections were measured by means of an index attached to the centre of the beam, and a scale so supported as to be independent of the rest of the system. The scale was isolated to avoid any irregular motions that might take place in consequence of the great weights it was necessary to employ; the supports, however, were so securely braced that no motions of the kind were observed. The scale was divided into parts, each of which corresponded to a deflection in the beam of 1-40th of an inch for one foot in length; as the distance between the points of support was 7.1 feet, it is easily seen that the length of one of these dimensions was 0.177 of an inch.

This deflection of 1-40th of an inch to one foot, was chosen as the unit of the scale, in consequence of its having been laid down by practical writers on the subject, as the greatest deflection of floor beams or joists, that should be allowed in practice.†

The bricks were slowly and carefully placed upon the platform by two assistants, who kept account of the number in an audible voice. As the beam was gradually bent by the increasing load, the moment when the index pointed to one of the divisions on the scale could be easily observed, at the same time the men, by their counting, gave information of the number of bricks on the platform, which being recorded opposite the deflection indicated by the scale, gave the weight producing that deflection. The men going steadily on, soon brought

* It is proper to remark, that although there is no reason to doubt that the spruce used was *Abies nigra,* and that the southern pine was *Pinus australis,* yet it obviously may be very difficult to establish with certainty the botanical name of a kind of wood seen only in the form of *timber.* In the present instance, an attentive consideration of all the circumstances, has given great confidence that the names adopted above are correct, yet those familiar with the subject will at once perceive that in certain cases, the timber of *Abies alba,* might easily be taken for that of *Abies nigra,* and that it might also be difficult to decide between *Pinus mitis* and *Pinus australis.*

† See Tredgold's Carpentry, p. 30 to 46, and Franklin Journal, vol 3.

the index down to another division, when the number of bricks was again recorded, and so on until the deflection was as great as it was proposed to make it, or until the beam was broken; in either case the load was immediately removed from the platform, a new specimen substituted, the index re-adjusted to the zero of the scale, and the same operations repeated. By this method the number of useful observations during each trial, was greatly augmented without causing any additional trouble.

From the foregoing description, it will be seen that the loads were not allowed much time to act upon the beams, from which it follows that the weights producing the different deflections are rather overrated. With regard to the object for which these trials were instituted, this was a matter of no importance, as it could not affect the relation between the different kinds of wood, and upon making some experiments to ascertain the amount of error, it was found so small that it might with safety be neglected.

In the first trial, for instance, (Table [A,] specimen, No. 1,) the load of 2662 pounds, which produced a deflection of 4-40ths of an inch to a foot, instead of being immediately removed, was allowed to remain suspended for two hours and forty minutes, when it was found that the centre of the beam had sunk only 0.077 of an inch.

The foregoing observations, with a few explanatory remarks, will, it is hoped, render the following tables intelligible.

Table (A.) *Detailed Statement of Experiments to determine the relative Stiffness of White Pine, Spruce and Southern Pine.*

Deflection in parts of an inch to one foot.	Whole deflection in inches.	White Pine.		Spruce.		Southern Pine.	
		No. of specimen.	Weight in pounds, producing the deflection.	No. of specimen.	Weight in pounds, producing the deflection.	No. of specimen.	Weight in pounds, producing the deflection.
$\frac{1}{320}$	0.022	1	111	4	126	7	217
$\frac{1}{40}$	0.177	"	836	"	737	"	1187
$\frac{2}{40}$	0.355	"	1516	"	1295	"	2252
$\frac{3}{40}$	0.532	"	2125	"	1960	"	3266
$\frac{4}{40}$	0.710	"	2662	"	2683	"	4078
$\frac{1}{320}$	0.022	2	126	5	131	8	222
$\frac{1}{40}$	0.177	"	715	"	973	"	1195
$\frac{2}{40}$	0.355	"	1448	"	1729	"	2270
$\frac{3}{40}$	0.532	"	2074	"	2464	"	3274
$\frac{4}{40}$	0.710	"	2708	"	3119	"	4259
$\frac{1}{320}$	0.022	3	126	6	146	9	217
$\frac{1}{40}$	0.177	"	781	"	968	"	1145
$\frac{2}{40}$	0.355	"	1491	"	1815	"	2134
$\frac{3}{40}$	0.532	"	2125	"	2449	"	3037
$\frac{4}{40}$	0.710	"	2733	"	3098	"	3996

REMARKS.

Whole length of specimens in feet, 9.389
Bearing length in feet, 7.1
Breadth in inches, 2.75
Depth in inches, 5.5

In these trials, each specimen, upon being relieved of the load producing the greatest deflection, sprung back by the elasticity of the wood, until the centre came within about 0.046 inches of being as high as it was before the experiment commenced. This deflection of 0.046 inches, would have been still further reduced had more time been allowed; the elasticity of the wood, therefore, remained entire.

TABLE (B.) *Being a condensation of the results given in Table* (A,) *with other facts connected therewith.*

Kind of Wood.	Specific gravity.	Weight of a cubic foot.	Deflection in parts of an inch to one foot.	Whole deflection in inches.	Weight in pounds producing deflection.	Differences for each division on the scale of deflections.	Constant quantity (a) in the expression for stiffness, $\frac{B \times D^3}{a \times L^2} = W$.
White Pine.	.455	28.43	$\frac{1}{320}$	0.022	121		
			$\frac{1}{40}$	0.177	777	777	a=0.0116811
			$\frac{2}{40}$	0.355	1485	708	a=0.0061119
			$\frac{3}{40}$	0.532	2108	623	a=0.0043056
			$\frac{4}{40}$	0.710	2701	593	a=0.0033603
Spruce.	.490	30.63	$\frac{1}{320}$	0.022	134		
			$\frac{1}{40}$	0.177	892	892	a=0.0101751
			$\frac{2}{40}$	0.355	1613	721	a=0.0056269
			$\frac{3}{40}$	0.532	2291	678	a=0.0039617
			$\frac{4}{40}$	0.710	2966	675	a=0.0030601
Southern Pine.	.872	54.50	$\frac{1}{320}$	0.022	218		
			$\frac{1}{40}$	0.177	1175	1175	a=0.0077244
			$\frac{2}{40}$	0.355	2218	1043	a=0.0040921
			$\frac{3}{40}$	0.532	3192	974	a=0.0028434
			$\frac{4}{40}$	0.710	4111	919	a=0.0022078
a	*b*	*c*	*d*	*e*	*f*	*g*	*h*

REMARKS.

In the expression for stiffness, $\frac{B \times D^3}{a \times L^2} = W$, (col. *h*,)

(B) represents the breadth in inches,
(D) the depth in inches,
(L) the bearing-length in feet, and
(W) the weight.

The constant number (a) has been calculated for the different deflections from one-fortieth of an inch for one foot to four-fortieths, inclusive, but in practice the deflection should, generally, not be allowed to exceed one-fortieth of an inch for each foot in length. In works on this subject, it is laid down as a rule, that if we wish to give a deflection double, treble, or quadruple, the ordinary deflection of one-fortieth of an inch to one foot, we must divide the constant (a,) determined for a deflection of one-fortieth of an inch, by 2, 3, or 4, for the new constant required. We are enabled by this table to make a comparison between the results thus obtained, and those arising from direct experiment. For instance: for White Pine, the constant number for one-fortieth of an inch deflection, is 0.0116811, which divided by 2 for a deflection of two-fortieths, gives 0.0058405, whereas in this table, the constant for a deflection of two-fortieths of an inch is 0.0061119. The differeuce is 0.0002714; with a greater deflection, the difference between the result of the two methods would be greater.

TABLE (C.) *Experiments to ascertain the circumstances of fracture, giving the aggregate of the results for each kind of wood.*

Kind of Wood.	Deflection in parts of an inch to one foot.	Whole deflection in inches.	Deflection at moment of FRACTURE.	Whole deflection in inches at moment of FRACTURE.	Weight in pounds producing deflection.	Weight producing FRACTURE.	Differences for each division on the scale of deflections.	Comparative strength of white pine, spruce and southern pine, white pine being unit.	Value of the constant quantity (c) in the expression for *strength*, $\frac{B \times D^2 \times c}{L} = W$.
White Pine.	4/40	0.710			2656		664		
	5/40	0.887			3217		561		
	6/40	1.065			3745		528		
	7/40	1.242			4062		317		
	8/40	1.420			4266		204		
	9/40	1.597			4390		124		
	10/40	1.775			4560		170		
	11/40	1.952			4664		104		
	12/40	2.130			4775		111		
	13/40	2.307			4833		58		
	14/40	2.485			4893		60		
			16/40	2.840		5189		1.000	$c = 443$
Spruce.	4/40	0.710			2806		701		
	5/40	0.887			3505		699		
	6/40	1.065			3955		450		
	7/40	1.242			4443		488		
	8/40	1.420			4705		262		
	9/40	1.597			4877		172		
	10/40	1.775			5051		174		
	11/40	1.952			5185		134		
	12/40	2.130			5324		139		
	13/40	2.307			5441		117		
			15/40	2.662		5646		1.101	$c = 482$
Southern Pine.	4/40	0.710			3698		924		
	5/40	0.887			4611		913		
	6/40	1.065			5487		876		
	7/40	1.242			6268		781		
	8/40	1.420			7049		781		
	9/40	1.597			7593		544		
	10/40	1.775			8033		440		
	11/40	1.952			8429		396		
	12/40	2.130			8578		149		
			14/40	2.485		9237		1.780	$c = 788$
	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*

Remark on the foregoing Table.

In the expression for strength $\frac{B \times D^2 \times c}{L} = W$, column *i*, the letters B, D, L, and W, have the same signification as in Table (B.) (See note at the conclusion of this article, page 236.)

TABLE (D.) *Relative stiffness of White Pine, Spruce and Southern Pine, at different deflections, White Pine at each particular deflection being taken as the unit.*

RATIOS OF STIFFNESS.			
Deflection in parts of an inch to one foot.	White Pine.	Spruce.	Southern Pine.
$\frac{1}{320}$	1.	1.107	1.801
$\frac{1}{40}$	1.	1.148	1.512
$\frac{2}{40}$	1.	1.086	1.493
$\frac{3}{40}$	1.	1.087	1.514
$\frac{4}{40}$	1.	1.098	1.522
$\frac{5}{40}$	1.	1.078	1.532
$\frac{6}{40}$	1.	1.056	1.465
$\frac{7}{40}$	1.	1.096	1.543
$\frac{8}{40}$	1.	1.102	1.652
$\frac{9}{40}$	1.	1.110	1.729
$\frac{10}{40}$	1.	1.107	1.761
$\frac{11}{40}$	1.	1.111	1.807

Observations on the foregoing Tables.

Although table (B) embodies all the information given in table (A,) it is nevertheless thought of some importance to present the results actually obtained in the experiments, the mind is thereby better satisfied, and in this instance the general agreement of those results will tend to inspire confidence. Table (C) contains the average of the results of the original experiments under that head, which were found to harmonize with each other in the same general manner as those of table (A.) It may be remarked with reference to the weight producing fracture, that the results given in table (C) are slightly overrated, in consequence of the small time occupied in making the experiments; this, however, is no practical disadvantage, as in calculating the strength of timber from algebraical formulæ, large allowance must always be made to provide against accidental defects.

It was observed in all these experiments, that the failures of the wood began at the top. The upper fibres, for rather less than half the depth of the beam, were gradually crushed and broken off in the bending of the specimen, and at last when no more weight could be supported, a fracture suddenly took place, the lower fibres being drawn asunder. It seemed that the bending took place more in consequence of the crushing of the upper fibres than the extension of

the lower ones. The fractures were not sufficiently regular to permit any comparison to be drawn as to the relative number of fibres crushed and drawn asunder in the different kinds of wood.

The results in columns (*g*) of tables (B) and (C,) indicate the weights which were required to bend the specimens through an additional division on the scale of deflections. If the deflections were always as the weights producing them, it is evident that all the differences in columns (*g*,) would, for the same kind of wood, be equal. It is easily seen, however, as might have been anticipated, that after having passed with considerable regularity through the first two or three divisions, the deflections begin to increase in a much greater ratio than the weights. From this cause it is very important that in experiments on the stiffness of timber, small deflections only should be tried, and that those deflections should be accurately measured.

It may be seen that the weights producing deflections of 4-40ths of an inch to one foot are less in table (C) than in table (B,) the reason for which is, that the stiffness of the wood was diminished by the first trials.

A circumstance of a practical nature connected with these experiments, deserves to be noticed, as it may possibly have modified the results in a slight degree. It was necessary in suspending the load from the beam, to adopt some precaution to prevent the iron band connected with the platform, from cutting into the wood, and thereby crippling the timber. The annexed sketch will indicate more clearly than any description, the means that were employed.

Fig. 1.

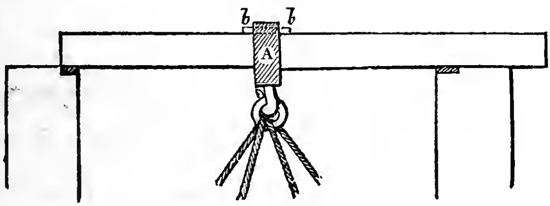


Fig. 2.

(A,) Figs. (1) and (2) is a strong iron collar, three inches wide and half an inch thick, embracing the specimen under trial, from which, by means of the hook below, the platform containing the load was suspended: (*b*) represents a bar of iron 2.75 inches wide, six inches long, and half an inch thick, resting upon the wood underneath the collar.

It is therefore evident that the load was not applied precisely at the centre point, but upon a surface six inches long, the centre of which corresponded with the centre of the bearing length.

In every instance when the beam was broken, the fracture took place at one end of the bar (*b*), and therefore at the distance of three inches from the true centre.

In the trials relating to stiffness, tables (A) and (B,) it is not supposed that this bar modified the results in any appreciable degree, that is to say, the results given in these tables may, without any sensible error, be considered as having been obtained by applying the

weight precisely at the centre. The case is different, however, with the results given in table (C); but since the error, whatever it may be, (and that it must be small is evident,) does not affect the comparison of the woods, it is of no consequence as to the particular object had in view.

Some of the *general* inferences to be drawn from the foregoing experiments, are:—

1st. That within certain limits, which extend much further than it is proper in practice to suffer wood to bend, the deflections are very nearly as the weights producing them; see table (B,) column (*g*.)

2nd. When we have a given weight to sustain, so that the deflections shall not exceed 1-40 of an inch to one foot, other circumstances being equal, ten beams of southern pine are equivalent, nearly, to thirteen of spruce or to fifteen of white pine. When the deflections to which the timber is exposed are very much less than 1-40th of an inch to one foot, or when we merely wish to guard against fracture, the disproportion between southern pine and the other woods, is much greater; see 2nd and 1st lines, table (D) and column (*h*,) table (C.) It was to obtain the results given in this paragraph, that these experiments were instituted. [*Silliman's Journal.*

Note by the Author.

For the benefit of those who do not understand the use of algebraic formulæ, it may not be amiss to translate into ordinary language the expressions for stiffness and for strength found in tables (B) and (C.)

The expression for stiffness $\frac{B \times D^3}{a. \times L^2} = W$, (Table B,) amounts, in common language, to the following

Rule.

1. Multiply the breadth, (in inches,) three times by the depth, (in inches.)

2. Multiply the constant number (a) twice by the bearing-length (in feet.) This constant number (a) is to be found in Table (B,) opposite the name of the kind of wood, and particular deflection desired.

3. Divide the result of the first operation by that of the second, and the quotient is the weight, in pounds, which may be placed on the centre of the beam, so that its deflection shall not exceed the deflection desired.

Example 1.—Required to find the weight which may be placed on the centre of a white pine beam, the distance between the supports near its ends being 20 feet, its breadth 6 inches, and its depth 12 inches, so that the deflection shall not exceed one-fortieth of an inch for every foot of its length, or, in other words, so that the whole depression at its centre shall not exceed twenty-fortieths, or half an inch.

In Table (B) we find the number (a) for a deflection of one-fortieth of an inch in White Pine to be 0.0116811. Then, 6 inches (the breadth,) multiplied three times by 12 inches, (the depth,) gives - - - - 10368 (1st.)

0.0116811 multiplied twice by 20, (the length in feet,) gives - - - - 4.672 (2nd.)

Divide the first by the second, and we have - 2219 for the weight, in pounds, which may be placed at the centre of the beam.

Example 2.—Suppose that a stick of Southern Pine, 12 inches deep, and having a bearing-length of 15 feet, is required to support at the centre a weight of 16891 pounds, how broad must it be, so that the deflection shall not exceed two-fortieths, or one-twentieth of an inch to a foot; that is, so that the centre shall not be depressed more than fifteen-twentieths, or three-fourths of an inch.

In this case, as we wish to obtain the breadth of the beam, we must multiply the weight, in pounds, twice by the length in feet, and that product by the number (a) and divide the result by the depth, (in inches,) multiplied twice by itself. We find from Table (B,) the number (a) opposite the deflection of two-fortieths of an inch in Southern pine, to be 0.0040921. Then 16891 multiplied twice by 15, and by 0.0040921, gives - - 15552 (1st.)
12, the depth in inches, multiplied twice by itself,
gives - - - - - - 1728 (2nd.)
The first divided by the second, gives - 9 inches.

The beam must then be 9 inches broad to fulfil the condition required.

The expression for the strength of timber $\frac{B.\times D^2.\times c}{L} = W$, (Table C,) which expresses the resistance to fracture, may be translated into the following

Rule.

Multiply the breadth, (in inches,) twice by the depth, (in inches,) and the product by the constant number (c) for that particular kind of wood. The result thus obtained divided by the bearing-length, (in feet,) gives the weight, in pounds, which will just break the beam.

Example. Required to find the weight which a beam of Southern Pine, 20 feet long between the supports, 10 inches broad, and 12 inches deep, will support at the centre, without breaking.

In this case the number (c) is 788 (Table C, col. *i.*) Then 10 inches, (the breadth,) multiplied twice by 12 inches, (the depth,) and the last product by 788 (c) gives - 1134720 (1st.)
Divide this by 20, (bearing-length in feet,) and
we have - - - - 56736 pounds,
the weight required to break the timber.

It must be borne in mind that these results are true only for the finest qualities of well seasoned timber. Green timber is neither as stiff nor as strong as that which has been seasoned, and deductions must be made to guard against defects.

These illustrations will fully exemplify the value, to practical men, of accurate experiments upon the stiffness and strength of timber. "To know the resistance which a piece of timber offers to any force tending to change its form, is one of the most important species of knowledge that a carpenter has to acquire; and to be able to judge of the degree of resistance from observation only, even in common cases, requires nothing less than the practice of a life devoted wholly

to carpentry. Besides it is a species of knowledge that is confined to the person who has obtained it, and dies with him. It is a feeling of fitness that cannot be communicated, nor yet described; nevertheless it is a feeling that every thinking, practical man is sensible he possesses. I am far from having a wish to banish the nice observation that gives birth to this feeling; because it is more desirable that it should be encouraged than suppressed: but there are cases where it fails; that is, when the magnitude of the object is beyond the range of ordinary practice; and when new combinations are attempted. In such cases the laws of the resistance of solids should be referred to, even by the expert practical man; and he will be better able to judge of their correctness if he finds them, in common cases, to give results that agree with those he has drawn from practice."* In Tredgold's Carpentry, and other similar works, may be found the constant numbers (a) and (c) for nearly all the kinds of wood useful in the arts; but besides that these numbers are in many instances calculated from insufficient experiments, most of the specimens used in the trials were of European growth, and, of course, the results obtained are inapplicable to American timber, though bearing the same name. It is much to be desired that numerous and accurate experiments be made, in this country, by those having the requisite zeal and opportunities; our architects will then know with certainty the qualities of the different kinds of wood they are using, and instead of working at hazard and in the dark, as they now too often do, they will be guided by the sure light of practical science to certain and definite results. If these experiments contribute, ever so little, to the attainment of so important a result, the object of their publication will be fully accomplished.

On the Straight Edge.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Mr. Editor,—The difficulty and expense of making Straight Edges of considerable length, render any improvement in these indispensable tools a desideratum. The usual mode taken to make them accurate, is to secure together three thin bars of steel, and file them together to a uniform breadth, or as nearly so as practicable; then to separate them, and compare their edges respectively with each other: if when the ends are reversed and the edges again compared, they should correspond, they may be considered, for all practicable purposes, perfect.

This method being tedious and expensive, good straight edges of more than three or four feet in length are rarely to be met with, and highly prized when obtained. When they are required of greater length, a serious difficulty occurs in their use. The slightest lateral deviation from a straight line will, of course, affect the accuracy of the instrument; consequently, the bar must be made so inflexible that it will not bend when inclined to the side, and, of course, becomes a cumbrous tool. To remedy the last difficulty, an ingenious mechanic of this city constructed one of a cylindrical form, of

* Tredgold.

iron cast hollow, about two inches diameter, and turned so thin that its weight was not objectionable, while its form rendered it inflexible to a considerable length, and in use was found quite as convenient as the flat straight edge. The cylinder being first turned in a slide lathe, and then ground with emery in a lead cap made to fit the circle, produced an instrument of great accuracy, at trifling expense.

We have been led to these remarks by observing at a workshop in this city, a straight edge so simple and cheap, that we almost doubted its novelty, though we confess such a one never before came under our notice.* It was made of steel harpsichord wire, stretched upon the edge of a board or frame and kept tight by screws—set screws were placed at each end which passed to the under side of the wire, and suffered it to touch the work or not, at the option of the workman.

The instrument we saw was twelve feet in length, and was stretched to the whole extent of the lathe shears which were finishing by it. The wire being too fine to exhibit the inequalities of the work to the eye, the operator set the points of the screws so far beneath the wire that it should only touch at the more prominent places, and then on passing along the work, discovered, by depressing the wire, where it touched and where it did not. The trouble attending the use of this instrument made it more convenient to use a wooden straight edge for roughing down the work, but its great accuracy made it very valuable in finishing.

We have often seen fine thread fastened to a wooden bow for the same purpose, but such a tool can only be depended on when held to the side of the work, obliging the operator to turn it over whenever he wanted to examine his progress, (an operation inconvenient when working a heavy casting,) because the thread curved by its own weight. No such difficulty is experienced in using the above, as its tenacity is so great, that it will bear a strain sufficient to keep it perfectly straight. M.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN DECEMBER, 1830.

With Remarks and Exemplifications, by the Editor.

1. For an improved *Grist Mill*, called the 'Pressure or Weighted Grist Mill;' John Ambler, jr. and David C. Ambler, Berlin, Chenango county, New York, December 6.

This is a Grist Mill intended to operate with small stones; in its general construction it resembles some of the other portable grist mills, for which patents have been obtained. The particular differ-

* It is not new, but has been used for testing the straightness of gun barrels. —EDITOR.

ence between it and others, could not be pointed out without a minute investigation, in which few persons would feel interested. We give the claim, which is as follows.

"The parts to which we lay claim as original, is the weighting of the upper stone with heavy articles, as iron, lead, stone, &c. The manner in which the safety rod, or damsel, is made, which allows it to be oiled at the top, and its resting on the balance rim in such a manner as not to interfere with the balancing of the upper stone; and the using its damsel as a protecting rod, to protect the upper stone from raising farther than it is raised by the bridge tree."

We have seen samples of the flour manufactured by it, which appeared to be equal to that made in the larger mills, although the stones used were not more than 24 inches in diameter. Whether this arose from the mill being more skilfully made and managed, or from any inherent superiority in its structure, we are unable to say.

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2. For a machine for *Making Window Sashes;* Charles Thompson, Poughkeepsie, Dutchess county, New York, December 6.

It is proposed to combine together in one frame, 1st, a machine for sawing off and slitting the boards; 2nd, a machine for planing, striking, and rebating; 3d, a machine for sawing the tenons; 4th, a machine for mortising; 5th, a machine for sawing munnions and dovetails; 6th, a coping plane; 7th, a grooving machine.

The sawing is to be effected by circular saws. The planes are to be moved backward and forward by a crank motion, and the machinery generally is to be driven by drums and straps. "The improvements claimed, are the before described machines, when combined, for making window sashes."

In the separate machines there is little or no novelty, and judging by the claim, it would appear that the patentee is aware of this, as he does not claim any of the particular parts of either of them. There are already machines in successful operation for the same purpose with the foregoing; and although the present patentee might defend the particular combination described, provided neither of the individual machines interfere with existing claims, a patent, based upon the mere arrangement of parts, without a claim to actual novelty in any of the individual parts, does not appear to us to stand very securely; as an ingenious workman can, in most cases, very readily devise another arrangement, which shall be equally efficient, and have an equal claim to novelty.

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3. For a machine for *Thrashing and Winnowing Wheat* and other small grain; Thomas Burrall, Geneva, Ontario county, New York, December 6.

The thrashing is to be effected in the ordinary way, by means of a cylinder and hollow segment. There are to be cast iron side plates to sustain the cylinder and segment. A rake, screen, and fan wheel, are used in the winnowing or cleaning.

The most convenient mode of driving this machinery, we are told, is by horses, or oxen, upon an inclined wheel. This wheel the patentee says he has "improved by a new mode of graduating and governing its motion." This is effected, if we understand the description, by altering the inclination of the wheel, or the position of the animals. But of this part there is no drawing, and the explanation is not very clear. The claim is to "the *cast iron side plates* for the purpose above set forth. The arrangement and combination of the rake, racks, and fan, for separating the grain from the straw and chaff, in the manner described, and the swing bar for governing the inclined wheel by which the power is applied."

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4. For a machine for *Washing Clothes;* Alvan Foote, Granville, Licking county, Ohio, December 7.

The cloths are to be put into a revolving barrel, closed by a door. The barrel is to be turned by a crank in the ordinary way. The gudgeon upon which it turns at the opposite end is hollow, for the admission of steam. A boiler, furnished with a safety valve, is to supply the steam through a tube passing into the hollow gudgeon. We are not told any thing about a stuffing box at the junction of the two, to prevent the escape of the steam, *but this is a thing of course.*

"What I claim as my invention, is the mode of introducing the steam into the cylinder, through the gudgeon and pipe, as before described, when applied to machines for washing clothes."

In addition to the calamitous explosions on board of steam boats, we may shortly hear of the blowing up of washing machines, and the maiming of the poor old women who are to become engineers. The main security in this machinery, will be the difficulty of rendering the junctures steam tight; in which case the steam and the washerwoman may escape, uninjuring and uninjured.

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5. For a *Bed Key;* Judson Blake, and Daniel Cushing, Providence, Providence county, Rhode Island, December 14.

This bed key is to be of cast iron or other metal, and is to have two, three, four, or more, arms, each having a socket in it of different sizes, to fit different screw heads. There are five different forms represented, in which the key may be made, and fifty might be given.

"The superior utility of this improvement over the common bed key, consists in its fitting screws of a greater number of sizes, and in its being made of such materials, and in such a manner, as to cost less than the key now in use."

To be able to trace the successive steps by which an inventor of some complex machine arrives at the final result, would, in many cases, be highly interesting, but the task would be one of great difficulty. Although the invention before us, is not one of great complexity, it would still be no easy thing to assign to each of the heads

which have been engaged in maturing the plan, their respective shares of the merit due to them.

Would not a common iron brace, with two or three bits, having sockets of different sizes, answer the purpose intended better than the patented machine? We think it would, and are very sure that it would not interfere with this *new and original discovery.*

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6. For an improvement in the art of heating or warming rooms, dwelling houses, offices, hot houses, churches, or any other public or private building of any description, or size, by means of a machine, apparatus, or implement, which he denominates a "*Portable Steam and Hot Water Stove;*" Thomas Green Fessenden, Attorney at Law, Charlestown, Middlesex county, Massachusetts, December 14.

(See specification.)

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7. For an improvement in machinery *for Sawing Veneers;* Caleb B. Burnap, city of New York, December 14.

This machinery is designed to enable a circular saw of small diameter to saw veneers from wide logs. The circular saw is to be constructed like those commonly used for sawing veneers; that is, it is to have one fair face, and is supported on the opposite side by a shaft running in collars, like a collar and mandril lathe. The saw and its shaft is to be fixed in a vibrating frame, which will carry the saw up and down to the distance required for the width of the log to be cut. The veneer is to be turned off, out of the way of the saw-shaft, in the usual manner. The claim is to "the application of the vibratory motion to one or more circular saws for sawing veneers from a plain surface."

The mode of giving the vibratory motion is by the application of a crank and pitman. This, however, we need not describe, as the particular manner of doing this, which the patentee gives, forms no part of his claim.

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8. For a *Machine for Planting of Corn,* or corn and peas, in the drill form; Reuben Coffey, Burke county, North Carolina, December 14.

This planting machine bears a strong resemblance to many others. The general form of it is somewhat like that of a plough. There is a coulter in front to open a furrow; behind this is a wheel, which runs upon the ground, and has projecting spikes to insure its revolving. The seed is put into a hopper, and is caused to drop into the furrow, in proper quantity, by the action of the wheel. The earth is closed upon the seed, by a scraper, or pins, behind the wheel.

In the principle of the machine there is no novelty. There is no claim made, and to the drawing there are no written references.

9. For a *Portable Machine for conveying Animal Power of any kind to Machinery;* Joseph C. Gentrey, city of Philadelphia, December 14.

This may stand among the many extraordinary patents obtained for things, the novelty of which neither the patentee, or any other person, can point out. A lever, or sweep, to which a horse or other animal is to be attached, is to turn a vertical shaft. Upon this shaft is to be a cog wheel like that commonly employed; the cog wheel is to drive a pinion, which pinion turns a band or strap-wheel, eight feet in diameter. Here we are compelled to end our description, because we have given the whole; and the whole claim is to "the above described machine for conveying power of any kind to machinery."

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10. For an *Improvement in Distilling;* Thos. Gallaher, Liverpool, Perry county, Pennsylvania, December 14.

This is a steam distilling apparatus, the novelty of which must be judged of by those who know what has been already done in this way, after reading the claims of the patentee.

"What I claim as my invention, is the method of having an opening, or openings, passing through the boiler, for causing the fire to return through the boiler before it passes off into the flue, when applied to distilling. I also claim the method before described of causing the steam to return back from the doubler into the heater, and from thence through the mashing tub; and likewise placing the doubler apart from the other parts of the apparatus."

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11. For an improvement in the mode of *Extracting Oil from Cotton Seed;* Gideon Palmer, Montville, New London county, Connecticut, December 14.

"The seed being hulled in the usual way, is ground in an oil mill like flax seed. About three quarts of water are mixed with about 75 pounds of seed. The flour is then put into an iron cylinder and heated over a fire until steam is produced. It is then put into my patented oil press, and the oil extracted.

"The effect of this process is to extract much more oil than in the common mode of pressing the seed with the hull on. The oil cakes are also made much more valuable.

"What I claim as my own invention is the before described mode of extracting oil from cotton seed with the hull off, and not in the usual way with the hull on." "Gideon Palmer."

By turning to Vol. 3, No. 5, p. 260, it will be seen that on the 21st of January, 1829, Francis Follet, of Petersburg, Virginia, obtained a patent for hulling cotton seed, in order to prepare it for the oil press; and at p. 141 of our last volume, a letter addressed to the patentee, from Gen. Williams, of South Carolina, furnishes much information on the application and utility of this invention. The "mode of extracting oil from cotton seed with the hull off, and not

in the usual way with the hull on," is not now, therefore, a legitimate subject of claim.

We do not suppose that Mr. Palmer means to limit his claim to the pressing of cotton seed in his patented oil press, but that he would consider the Dutch pestle and wedge, as an interference with his right. Neither the moistening or the heating of seeds for the purpose of extracting their oil, are new. The keeping to the particular proportions named, may be so.

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12. For an improvement in the *Press for pressing oil, cotton, tobacco,* and other substances requiring great pressure; Gideon Palmer, Montville, New London county, Connecticut, December 14.

This press is to be operated upon by the gravity of water. At the lower part of the press, a vat, or cistern, is constructed, which is capable of being filled with water. Within this is placed a second cistern filled with water, and of about one-half of the depth of the former. When the outer vessel is filled, the inner one will float within it, and when the water is drawn off from the outer vessel, the inner will tend to descend with its load of water, which in the press described, would amount to nine tons. An upright shaft ascends from the inner cistern, to which it is firmly attached and secured by braces. This shaft operates upon the arms by which the pressure is to be made. The principle of the action of these arms is that of the toggle joint; each arm presses outwards against the sides, or cheeks of the press.

The seed, or other article to be pressed, is placed between boxes, or gripes, at each side. Against these boxes, or gripes, followers are forced by means of the jointed arms, which when the shaft is up, and the press out of action, rise, so as to form an angle with each other, and when in full action stand in the same horizontal line. The upper end of the shaft is in the form of a wedge, with its narrowest end downwards. This wedge stands between the inner ends of the arms, and operates, with their own descent, to force their opsite ends out upon the article to be pressed.

The press boxes, or gripes, between which the seed is to be pressed, "are made of bars of wrought iron, lined with sheet iron, bolted and keyed together at the corners, in such a manner, as to open and shut to receive and discharge their contents with ease and facility."

"What I particularly claim as a new and useful improvement in the oil press is, first. The application of a weight of water to press any substance requiring pressure, in the manner above described. Secondly. The formation of the press boxes, and application of these press boxes afore described to the ordinary screw and lever press. Thirdly. The wedge as applied in the press above described."

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13. For a mode of making or *manufacturing Shoes and Boots,* called the Farmer's double improved boot and shoe sole;

Moses Pennock, Marlborough, Chester county, Pennsylvania, December 14.

(See specification.)

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14. For an improvement in making *Wrought Iron Nails;* G. B. Manley, Canton, Norfolk county, Massachusetts, Dec. 14.

"Take good fibrous iron, and roll it the thickness of the nail required; the bar and the slab should pass through the rolls in the same manner as it is drawn, that the grain or fibre of the iron may be laid one way: then the sheets, or plates, are slit into strips, across the grain, of sufficient width for the length of the nail required; making proper allowance for drawing the edges."

The strips are then to be drawn by hand or strip hammers; and the heading is to be performed with dies, giving to them that shape which wrought nails require.

The claim is to the "drawing the edges of strips, either by hand hammers, or by tilt or trip hammers, or by rolling, which gives the nail the form and properties of the best wrought nails."

To us, who have frequently witnessed the rapidity with which the nailers form wrought nails from rods, it appears improbable that much advantage in point of expedition can be gained by the plan of the present patentee, as after the rolling, each nail must be handled three times, whilst by the ordinary mode once is sufficient.

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15. For an improvement in the *mode of making Spoons;* Archibald Little, Bridgetown, Cumberland county, New Jersey, December 14.

The mode here patented is the employment of the common drop press, and steel dies. The lever or screw press, we are informed, will answer the purpose.

The claim is to "the mode of making spoons in dies, with the apparatus before described for that purpose, instead of the usual mode of hammering, or casting."

A patent for a similar purpose was granted on the 27th of December, to Robert Butcher of Philadelphia; but we believe this latter gentleman intends, principally, to raise spoons out of sheet tin. The specification of his patent will be found in the present number.

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16. For a *Thrashing Machine;* George Jessup, Troy, Renselaer county, New York, December 14.

The claims are

"The having the thrashing wheel or cylinder, revolve upon points or centres, as contra-distinguished from gudgeons."

"The manner in which the upper fluted roller is made moveable up and down, and in which the necessary degree of pressure of the roller upon the straw is effected."

"And in the horse machine,

"The manner in which the power and motion are communicated from the lever to the thrashing or other machine, to which the same are to be applied."

"The manner in which the motion may be accelerated."

"The manner in which the tension of the rope or band may be increased or lessened."

As these modes and manners do not bring to light any new principle, or combination, we need not describe them.

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17. For a *Water Wheel* for propelling Machinery; James Johnson, Fairbanks, Sullivan county, Indiana, December 14.

We cannot take the trouble to revert to any of the patents which are identical in principle with the present, nor will the readers of this journal require it. Leaves, or buckets, are hinged to arms projecting from the solid hub on the end of a shaft. The buckets are to open and close, like shutters, by the action of the current.

"Your petitioner claims the whole wheel above described to be his invention, the shaft excepted."

The shaft, and even thew ater itself, might be as fairly claimed, as is this whole wheel.

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18. For a *Machine for Propelling Machinery;* Thomas D. Newson, and James C. Shule, Nashville, Davison county, Tennessee, December 14.

The utter worthlessness of this machine will be at once perceived by every machinist, when we say that power is to be gained by means of a pendulum, which pendulum is to be kept in motion by a double rimmed cog wheel, each rim having cogs and intervals alternately; the alternate cogs are to take into a pinion, to keep the pendulum swinging. Those who believe in the possibility of perpetual motion have gone beyond us, and are above our instruction; those who do not, have no need for it on an occasion like the present.

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19. For a *Circular Slide Rest*, to be used in the turning lathe, by which round balls, elliptical balls of any proportionate diameter, convex or concave surfaces, bowls, or segments of a circle may be turned; M. J. Gardner, York, York county, Pennsylvania, December 14.

The parts of this slide rest, are perfectly well delineated and described. The rest revolves upon a circular groove on a firm bed, and chisels of different kinds may be fixed in the upper part of it. The whole is considered as new, no part being claimed. Its application to circles and to segments of circles is apparent, but we do not perceive how it is to be advantageously applied to "elliptical balls."

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20. For an improvement in the *Art of Sawing Timber;* David Stern, Venderburgh county, Indiana, December 14.

This saw mill is to be worked by horse, or other power. The carriage descends upon an inclined plane, and has to mount up hill by means of a tread wheel. The saw runs between fender posts in the usual way. The gearing consists of several wheels and pinions. The description and drawing are extremely imperfect; there is no claim, and nothing worth claiming, as neither in its principle or arrangement, does this machine offer any thing that is new or valuable.

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21. For a *Machine for Cutting Paper;* John Shugert Quincey, Franklin county, Pennsylvania, December 14.

A cutting knife, very similar to that used for cutting dye woods, is fixed upon a bench. To insure its correct movements it works up and down between guides. To increase the power, the lever is made compound; that by which the handle of the knife is worked is attached to the bench by a joint; this lever is connected with the handle of the knife, by a jointed connecting rod. The paper to be cut is held upon the bench by a screw, and the sides of the ream are successively subjected to the action of the knife. The claim is to "the construction and arrangement of the above described machine for cutting paper, but particularly the compound lever and guides."

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22. For an improvement in the *Art of Making and Curing Salted Beef,* and particularly of the description called jerked beef; William A. Tomlinson, city of New York, December 14.

(See specification.)

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23. For an *Economical Oven;* Abel Stowell, Medford, Middlesex county, Massachusetts, December 14.

This is intended as an improvement on the common bake pan. A square box of iron is made, resembling the oven in a common cooking stove, and having a door on one side in the same manner. This box has a bail to it, by which it may be suspended, and has legs that it may stand on the hearth, with fire beneath it. Within the oven there is a moveable shelf dividing it into two parts. On its top there is a ledge, like that on the lid of a bake oven, to retain the fuel placed on it.

"What I claim as my invention, is an improvement on the common baking pan, by making the opening through which the articles to be baked or cooked may be placed within, or withdrawn from the said oven in a lateral situation, and which opening may be closed by a door connected to the oven, instead of the moveable cover as is usual; by which means baking or cooking may be effected in a more economical, cleanly, and expeditious manner, without subjecting the operator to the inconveniencies attending the employment of the baking pan in common use."

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24. For a *Churn,* called a rocking churn; Nathaniel Tiffany,

and Ebenezer Robinson, Carolina, Tompkins county, New York, December 14.

A box is placed upon rockers, within this box slats are fixed, which serve as dashers, the cream passing between them as the churn is rocked. There is no claim.

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25. For an improvement in *Trusses for Hernia or Rupture;* James Knight, Baltimore, Maryland, December 14.

We shall merely give the claim of the patentee to what he deems his improvement upon Hull's truss.

"What I claim as my invention and improvement, is a truss which is made to press equally around the body, by means of an additional spring and fixed concave pad, the pressure being graduated by means of a strap and buckle, by which the truss is permanently sustained around the body, making it different in principle from all other trusses. My truss can be worn sitting, lying, or standing, with so little inconvenience as to be worn by the youngest infant."

The additional spring is a short elastic strip of metal, by which the pad is attached to the principal spring.

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26. For a *Compound Lever and Self-Weighing Scale;* Hosea H. Groover, Springwater, Livingston county, New York, December 17.

The specification of this patent describes seven different means of weighing by different apparatus, or by modifications of the same apparatus. The methods first described are on the principle of the steelyard, but are more complex, and we think less convenient than Dearborn's patent balance, an instrument which leaves but little to be desired in that way. The other means given are mere modifications of the bent lever, with an index to point out the weight.

The two kinds of apparatus, described and represented, appear to us to be so essentially different in their mode of action, as to require two separate patents. They are really different machines, although intended to attain the same end. The claim is to "the self weighing scale, and it compounded or blended with the steelyard or lever beam: and also the compounding the lever beam with the steelyard. The decimal graduations for weighing, and the appending cast iron notches and graduations to the wrought bar."

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27. For a *Machine for Shelling Corn;* William Hoyt, Vernon, Jennings county, Indiana, December 17.

This machine bears a strong resemblance to the first machine for shelling corn, which was patented some five and twenty years ago. A wooden cylinder has iron spikes driven into it, and between this and an elastic casing the corn is operated upon. The legs are framed together in the form of an X, and this appears to be one of the improvements claimed.

"The improvement which I claim is the particular construction or application of the frame to the machine.—Its simplicity.—The manner in which the machine is thrown in and out of gear by the moveable bridge trees. And the manner in which it discharges the cob, while the shelled corn passes through the machine.

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28. For an improvement in *Making Suspenders;* Allyn Baron, city of Philadelphia, December 17.

"The first improvement consists in substituting for brass or plated wire, which has been heretofore used for covering or wrapping the roller, pulley, or slide, spring, or cord, a substance commonly called sea grass."

"Second improvement consists in making use of a metallic ring, ferule, tube, plate, or piece; with holes to sew the same, and without holes, soldered and not soldered, to attach the said ring, ferule, tube, plate or piece, to the ends of roller, pulleys or slide, strings or cords for suspenders, whereby the said ends which have heretofore been knotted, burned, doubled, or whipped, are enlarged for the purpose of securing them to the loops, or button-hole pieces."

These may be great improvements, but the fraternity of suspender makers must judge of this. The law requires that there shall be "drawings, with written references, whenever the nature of the case admits of drawings." We are not aided by any thing of this kind, yet we think that a "metallic ferule, tube, plate or piece, with holes to sew the same," *admits of drawings.*

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29. For making and constructing *Steam Engine Boilers;* John C. Douglass, city of New York, December 17.

(See specification.)

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30. For a *Truss for the Cure of Reducible Inguinal Hernia;* Amos G. Hull, city of New York, December 20.

This is the fourth time a patent has been re-issued for this invention. It was first patented in July, 1817, surrendered and re-issued in February, 1823: again in August, 1824; again in October, 1829; and again as above.

These new patents all bear date with the first, and will expire on the 17th of July next. The object of surrendering and obtaining a new patent in the present instance is to use the amended specification in a litigated case. The lawyers certainly ought to know best, but we should be very apprehensive that a defective specification, which failed to explain clearly what was patented, would be likely to fail in sustaining what was intended, but omitted, to be described or claimed.

This truss is too well known to require description.

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31. For an improvement in the *Truss,* which the patentee

denominates the "Elastic Truss;" Gershom Twitchell, Leominster, Worcester county, Massachusetts, December 20.

The bow, or belt, or retractor, which surrounds the body, is to be made of Caoutchouc, (India rubber.) If pieces of sufficient length cannot be obtained, they are to be joined together by a cement made by dissolving the India rubber in about five times its own quantity of spirits of turpentine. This cement is to have the consistence of candied honey; the ends of the pieces to be joined are to be made perfectly clean, then thinly covered with the cement, and put for some hours under a press. The straps are at first cut of double their intended width, as they are to be folded over and their edges joined by the cement used for joining the ends. The caoutchouc strap is to be covered with soft leather; metallic clasps are to be attached to it, and metallic plates, with a cushion of caoutchouc; a covering of leather, hinges, and suitable springs, complete the truss. There is no claim made.

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32. For a *Washing Machine;* Ebenezer Lester, Killingworth, Middlesex county, Connecticut, December 20.

This washing machine differs in its structure and mode of operation from all those which we have hitherto described. It consists of a cylindrical vessel, the bottom of which is to be fluted on the inside, the flutes proceeding in radii from the centre; the sides are also to be fluted a few inches up. There is to be a dasher, consisting of a block of wood, with a shaft attached to it like that of a churn. The lower side of the dasher is to be fluted like the bottom of the vessel. The clothes are to be put into the vessel, with a sufficient quantity of water, and the dasher placed upon them; its shaft is to pass through a lid or cover. On the top of the dasher is a cross bar, or handle. "The machine may be operated by a person turning the dasher, horizontally, half, or quite, round and back. By this means a great saving of time and labour will be effected, without injury to the articles washed, as experiment has amply demonstrated."

"The inventor does not hereby claim as his invention, vessels, fluted work, or rollers, but merely the manner of improving them by uniting their operations in the mode above mentioned."

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33. For a *Washing Machine;* Samuel Bushnell, Sen. Saybrook, Middlesex county, Connecticut, December 20.

We may transcribe without any variation, what was said in our last number, p. 167, respecting a similar machine. "A swing frame with a roller at the bottom of it, is made to vibrate by hand. The clothes are placed in a trough, with bed pieces of suitable curvature."

There is no claim, and as similar machines have been long since patented, tried, and condemned, we apprehend that the want of a claim will not be a source of loss.

To this we may add, that the drawing is without written references.

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34. For a *Churn;* Samuel Bushnell, Sen. Saybrook, Middlesex county, Connecticut, December 20.

The shaft, or handle, of a common dasher churn is formed into a double rack, between the teeth of which a pinion is made to revolve by turning a crank. The teeth of the pinion are to take alternately into those of the racks, and the dasher is consequently to be made to rise and fall. A worse mode of accomplishing this purpose could not easily be devised.

There is no claim; no letters of reference to the drawing, and we may again add, but little likelihood of loss from these omissions.

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35. For a *Revolving Grate for Grating Apples,* and other vegetable substances; David Flagg, Jr., city of New York, December 20.

The grating is to be effected in a well known mode, that is, by a cylinder furnished with teeth. The improvement made consists in the vertical end of the hopper, just above the cylinder, being formed of slabs, or bars of wood, retained in their places by spiral springs, which will allow them to give way, when stones, or other hard substances, are encountered by the cylinder. To these the claim is confined.

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36. For an improvement in the *art of Boring Timber;* Frederick Beckwith, Saratoga, Saratoga county, New York, December 21.

A frame is made, having two uprights, or cheeks, like those of a standing press. Within this there is a sliding frame, passing freely up and down. A cylindrical vertical shaft fits and turns freely in holes at the top and bottom of the sliding frame; the augers, or bits, with which the boring is to be performed, are adapted to the lower end of the shaft. By means of a crank, or handle, motion is given to a vertical wheel, the cogs of which take into those of a horizontal wheel upon the shaft.

The machine is intended to be used in ship, bridge, and dock building, and for other purposes. We are not informed what part is claimed, and it resembles other machines for the same purpose so closely, that we should be at a loss in designating what is new in it.

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37. For an improvement in the *mode of Propelling Spindles,* or machines for spinning wool; Russel Phelps, Andover, Essex county, Massachusetts, December 21.

(See specification.)

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38. For a *Machine for Jointing and Gumming Old Saws;*

Henry Johnson Sidney, Delaware county, New York, December 23.

This is called an improvement on Newton's machine, for the same purpose. A lever, the fulcrum of which is near to one end, is used to force up a cutter with a triangular face, against a steel plate or bed. There is no difference in principle, but merely in arrangement, between this and the machine upon which it is called an improvement. The patentee, however, enumerates its good properties much at large. He tells us, for example, that "it need not be half the weight of Newton's." That "the principal plate need not exceed 13 inches in length," &c. The claims are to the particular manner in which this instrument is made. Among them is the "making the base, perpendicular, side guides to the driver, and supports to the fulcrum, all of one solid piece of iron," &c. &c.

In what the present patentee calls the original machine, we thought that there was but little originality, as may be seen by referring to our last volume, page 228. It must also be recollected that as this is confessedly an improvement upon Newton's machine, the consent of the original patentee is requisite to give a right to use the improvement.

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39. For an improvement in *Making Wheels for Carriages;* Joel Eastman, and Guy C. Rix, Bath, Grafton county, New Hampshire, December 23.

The spokes of the wheel are not to be driven into mortises, but are of such a size at their inner ends, that when laid together in their proper positions, they come in contact with each other to a distance of several inches, and sustain each other; an axle passes through the centre of the wheel, and is secured there by an iron plate on the outside, and another on the inside, which cover the joinings of the spokes, and are firmly pressed against them by screws, or otherwise.

The axle, which is to be of iron, is to be "laid into a wooden axle tree, and secured in such a way as to turn freely, and yet be perfectly secure against coming off."

"The invention here claimed, is the mode of making carriage wheels as before described."

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40. For a machine for *Cutting Screws, and Turning Iron and Steel;* Joel Eastman, and Charles Abbot, Bath, Grafton county, New Hampshire, December 23.

In this machine the cutting property of a disk of soft iron, or steel, when in rapid motion, is applied to the forming of threads upon screws of iron. The cutters are circular disks of from a foot to 4 or 5 feet in diameter, and of the thickness required. Their edges receive the form intended to be given to the thread of the screw, whether square, or angular. These wheels are fixed upon arbors, which are placed at such an angle with the piece to be cut, as the

intended thread may require. A sliding frame of iron, with the necessary slides, guide screws, and other adjustments, receives the piece upon which the screw is to be cut, and causes it to advance as the operation is performed. The claim "is the application of the iron or steel wheel in cutting screws, screw bolts, and taps, and turning iron, steel," &c.

This, we believe, is the first machine to which the remarkable property possessed by soft iron in rapid motion, has been applied; excepting the occasional use of it as a cutter in the lathe. The machine is in actual operation, and we are assured, upon good authority, that it not only acts perfectly well, but performs the labour of cutting screws with a degree of rapidity, which leaves at a great distance, every other known mode of effecting this object.

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41. For an improvement in *Percussion Gun Locks;* Michael Carleton, Haverhill, Grafton county, New Hampshire, December 23.

A straight bar of steel is contained within the stock, behind the breech pin. This, by sliding forward, is to operate as a hammer, to fire the powder. The guard operates as a spring to force this bar forward, the fore end of it passing through a small mortise, and entering a notch in the box, or hammer. When the hammer is drawn back, it is caught and held by the trigger. There is a very minute description of all the parts of the lock, but no claim made; we are not aware, therefore, of what is intended to be patented. Percussion guns have been made to resemble walking sticks, and a hammer used, the position of which was like that described: concealed locks of various kinds are also known to those conversant with this subject. We see nothing in the present plan which offers much either of novelty or utility.

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42. For an improvement in *Machines for Separating Gold from Sand, Earth, &c.;* Frederick D. Sanno, Philadelphia county, Pennsylvania, December 24.

This patent is taken for two machines, to be used either alone or in succession. The apparatus the patentee calls the *American Gold Finder;* without the drawings the particular arrangement of the parts cannot be explained. The first machine is called a preparer; in this the particles of gold are to be separated from the stones, and the lighter portions of earth. The washing is effected in a cylindrical vessel placed like a bolter, allowing the heavier particles to pass through into a box below. This portion is to be further washed in the second machine, which is called a cleansing machine. In this it is subjected to the action of sieves, vibrating troughs, and other appurtenances. The claim is as follows.

"What I claim as my invention is the construction and arrangement of the before described machines for separating gold from earth, stones," &c.

This general kind of claim, when a machine consists of many parts not new in their structure, does not appear to us to fulfil the requirement of the patent law, which makes it necessary that the applicant for a patent for any machine should distinguish the same "from all other things before known."

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43. For a method of *Manufacturing Spoons from Tin Plate,* Tin or Pewter in sheets, sheet Silver, or other metal; Robert Butcher, city of Philadelphia, December 27.

(See specification.)

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44. For an improvement in the machine for *Trashing Wheat,* and other grain; Rufus Humpreys Victor, Ontario county, New York, December 27.

This machine is so precisely like a great many other thrashing machines, that we should not, unaided, have discovered any point of difference; the patentee, however, informs us that "it differs from all machinery of this kind now in use, in the simplicity of its machinery, and the cheapness of its construction, it being designed to be propelled by one horse." This one horse is to apply his power in the usual manner. In this thrashing machine, "the rows of teeth on the cylinder play between similar teeth, fixed in the same manner on a bed piece. The cylinder and bed piece are both covered with sheet iron, and the teeth are drove through this. Between this bed piece and the cylinder the straw to be thrashed passes. The machine is fed by an apron leading to the cylinder, in the common way." Thus endeth the specification; there being nothing in the form of a claim, unless the *simplicity*, and *cheapness*, are intended as such; but to us these are not only intangible, but invisible.

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45. For an improvement in the mode of *Making Ivory, Bone, and Wood Combs;* Julius Pratt, Minden, New Haven county, Connecticut, December 28.

The back of the comb is to be made in a separate piece, and it is recommended to form it by turning. This piece is to be drilled to receive the teeth, which are also to be in separate pieces, and are to be formed by turning, or otherwise. Both the back and the teeth are to have the grain of the material running lengthwise.

"This improvement in the combs made in this manner, for which a patent is claimed, consists in having the back and teeth of the comb both running with the grain of the material of which they are made, whereby their strength and durability are greatly increased. This improvement is particularly useful in the making of ivory combs, as it greatly increases their strength and durability, and enables the operator to construct the teeth of the comb out of pieces, or chips of ivory, which are nearly useless for other purposes."

"I claim as my invention and improvement the comb of the above description, made of ivory, bone, or wood, with the grain running

lengthwise with the teeth and back. I also claim as my invention and improvement, the mode of forming the back and teeth by turning them, as above described."

The present patentee, if he is "the true and original inventor," has been rather tardy in asserting his claims. On the 14th of April 1829, Nathaniel Bricknell of Connecticut obtained a patent, in which it is stated that "this improvement consists in forming the back of a comb in a separate piece, or separate pieces of wood, so fastened to the back of the comb blade as that the grain will run at right angles with the grain of the wood forming the comb blade and comb teeth."

On the 11th of June in the same year, a patent issued to John Brown, of Providence, Rhode Island, for making small toothed combs out of small scraps, by connecting such pieces to pieces of hard wood, horn, or any other suitable substance.

The interference of these claims is perfectly manifest, and either one or the other of these patents must be untenable.

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46. For an improvement in the *Steam Engine*, and feeder of the boiler; Ogden Mallory, Oswego, Oswego county, New York, December 28.

The object in view will be seen by the following claim.

"What I claim as new, and as my own invention, or discovery, is the application or power of steam to a reciprocating, or semi-circular cylinder, or engine, or a semi-reciprocating rotary motion, or piston head, or wing, &c. And obtaining from such reciprocating or semi-rotary motion, or piston head, a full rotary motion; and thereby obtain the power of steam for propelling or driving machinery of all kinds," &c.

"And for feeding the boiler by a turning or revolving cock or cylinder, and keeping the water regular in the boiler, and at its proper point at all times," &c.

"And for regulating the force pump, or the supply of water for the boiler, by means of a valve or stop cock attached to the force pump, and adjusted by means of being connected to a weight in the boiler, which rises, or falls, with the water in the boiler."

Without possessing any of the advantages proposed by the rotary engine, the one here offered appears to us to unite all the objections to it; and we apprehend that it will be as difficult to obviate them as to make a "*semicircular cylinder.*"

A semi-cylinder is made, and closed at its ends, and across its diameter. Within this a wing is fitted, which is attached to a shaft, working on gudgeons in the centre of the circle, of which the semi-cylinder is a section. This wing must be packed so as to fit at its three edges, and the shaft to which it is attached, must also be packed to render it steam tight. The steam is to be admitted and discharged from each side of the wing alternately; and it is thus to be made to vibrate. A crank, or lever, firmly attached to one end of the shaft, gives motion to a fly wheel, by means of a shackle bar, or pitman. So much for this part of the invention.

The feeding is to be effected by means of a revolving, or vibrating cock or cylinder, which having cavities in it receives water from a supply vessel above, and carries it down, so as to deliver it within the boiler. This is one of the *Modern antiques*, which has been used both with, and without the sanction of a patent.

The third improvement is to be carried into effect by means of a float in the boiler, having a rod attached to it, which passes through a stuffing box. The upper end of this rod, is to be made to operate upon a cock, or valve, connected with the force pump, so as to regulate the quantity of water it shall supply. If floats, cocks, and force pumps, were not liable to get out of order, a contrivance of this sort might possibly be relied on; but as such is not the fact, this and the analogous appendages which have preceded it, are not likely to afford the desired security.

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47. For an improvement in the mode of *making Cotton Roving;* Samuel P. Mason, Leesville, Middlesex county, Connecticut. Patent first issued June 24th, 1830. Cancelled and reissued, December 29.

The specification commences by saying, "the essential principle which I claim in the speeder for making cotton roving, and which distinguishes it from all other speeders now in use, consists in the peculiar structure of the spindle, and the application of the flyer to that spindle."

The objection of a want of claim, which we originally made, is here removed; but the remark respecting the impracticability of making the nature of this machinery known without the drawing, still applies. We do not, therefore, attempt a description of it.

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48. For a *Machine for Tempering Clay and Moulding Bricks;* John C. Porter, Powhatan county, Virginia, December 29.

The clay is tempered by pairs of rollers running in troughs: there may be three, or more, such pairs placed below each other; the clay is placed above the upper rollers, and passes down through those below. A supply of water is admitted to the upper trough, in quantities sufficient for the intended purpose.

The moulding is effected in a circular trough. This trough is constructed much like those most commonly employed for tempering clay, and it has also a vertical shaft, and a roller running round in it, in a manner similar to those used for that purpose; but in the present instance the roller is employed to press the tempered clay into moulds. Single or double moulds are placed round in the trough, there being proper openings in the side of it to admit them. The tempered clay is placed within the trough, and the roller passing over it, presses it into the moulds. An iron scraper follows the roller, and removes the superfluous clay from the moulds. The bricks are then to be discharged, and the moulds replaced.

The claim is to "the machine, before described, for tempering clay, and moulding bricks; particularly the circular trough, the supports to the moulds, the cylindrical presser, and scraper."

If the claim to the whole machine is good, those to the particular parts are, at least, superfluous; if the claim is not good, it cannot be sustained by claiming the particular parts.

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49. For a mode of *Causing Cloth to pass, and be stretched while passing, over a Revolving Cylinder* prepared with points, or teazles, for teazing, or raising, the pile or nap upon cloth; John Jewell, Dudley, Worcester county, Massachusetts, December 30.

The specification of this patent is written with unusual precision and clearness, and the machinery described is well represented. All we can give is a general idea of the plan pursued, so far as it can be understood by a quotation from the beginning, and another from the end of the specification. The whole description would occupy several pages of the Journal.

"The cloth to be teazed, is to be wound upon a revolving cloth beam, and from that made to pass over and under rollers, and over the revolving cylinder prepared for teazing it; and over and under rollers on another revolving cloth beam, on which it is to be wound up as it comes from the first beam, after having passed over and under the rollers and cylinder aforesaid; and then, by a change of motion, after it has been unwound from the first beam, it may be made to pass back over and under the rollers and cylinder aforesaid, and be again wound upon the first beam, as it comes off from the beam upon which it was last wound up, the motion of the cloth beam and rollers being given, regulated, and changed, in the manner hereinafter described and explained, which description may be best understood by reference to the plan hereunto annexed."

Conclusion.—"It is to be understood that although I have in my plans, and the explanation thereof, mentioned a cylinder prepared with points or teazles, for teazing cloth, yet, I do not claim as a part of my invention, such a cylinder, either separately, or in combination, nor the raising of naps on cloth by means thereof; and although I have mentioned stretching rollers, which ought to be the stretching rollers now used for stretching the cloth widthwise, yet I do not claim the same, either separately or in combination, as a part of my invention, nor the stretching of cloth widthwise. And, as to the rest of the machinery described, none of it is claimed separately, and only so much of it in combination as is adapted to give motion to, and regulate and change the motion of, the feeding rollers, so as to regulate and change alternately the motion of the cloth, and draw it tight and smooth over the cylinder prepared for raising the nap upon it."

Specifications of American Patents.

Specification of a patent for an improvement in the art of heating or warming rooms, dwelling houses, offices, hot houses, churches, or any other public or private building, of any description or size, by means of a machine, apparatus, or implement, which he denominates a "Portable Steam and Hot Water Stove." Granted to Thomas Green Fessenden, *Attorney at Law, Charlestown, Middlesex county, Massachusetts, December* 14, 1830.

My improvement consists in a portable steam and hot water stove, which may be constructed as follows, viz. the case, or outside, may be made of cast iron, sheet iron, wrought iron, or any materials which will withstand fire; including all those which are or may be used for fabricating stoves or fire places. This case may be a hollow cylinder, or of an elliptical shape, a square, a parallelogram, or any other shape which taste, convenience, or fancy may dictate. Its dimensions should be of a size proportioned to the size of the room which it is wished to warm. A cylinder, 24 inches in length and 12 inches in diameter, fitted with boilers and tubes, as hereafter mentioned, has been found by experiment sufficient to heat about 3000 cubic feet of space in a room finished in the common style, and as well adapted as usual for the exclusion of external air. The case of the stove may be placed in a perpendicular position, elevated on legs or otherwise, so as to stand about two inches above the hearth or floor of the apartment. The lower end of the cylinder being closed with a plate of iron, or other suitable substance, serving for the bottom of the ash pit, which may occupy about 6 inches of the lower end of the cylinder. This plate may also extend several inches in front of the stove, and its exterior extremity being properly supported by legs or otherwise, answer the same purpose as a hearth for a fire place, and a footstool, or stand, on which the feet may be placed for warming. An aperture closed by a door near the bottom of the cylinder is used for taking away the ashes. This door may be fitted with a register to admit more or less air, as in common stoves.

Immediately above the ash pit, within the cylinder, is placed one or more boilers. The first, or lower boiler, is hollow sided, and consists of two concentric tubes of equal lengths, but of different diameters; the length about five inches, and the diameter of the outside tube just equal to the interior diameter of the case; so that the sides of the case and the boiler may sit close, and no air admitted between them can make its way over the fire place and carry off the heat. The tube which constitutes the inner part of the boiler, is about two inches less in diameter than the outside tube, which forms the exterior part of the boiler. Circular end pieces are soldered between the tubes at both ends; the upper end piece being perforat-

ed with several holes to admit two, or more tubes, leading to a second boiler; and, likewise, there is an advantage in having two, or more tubes, leading to the first steam receiver, as well as two, or more tubes, of about an inch in diameter, placed on the same level, and crossing the interior of the boiler, near its bottom.

Within the hollow sided boiler, is placed a grate, on which is a hollow, cylindrical vessel of cast iron, or other suitable metal, or substance, for a fire pot. These should be so shaped and placed, as not to touch any part of the boiler, or tubes, before mentioned, lest, when heated to a red heat, they should burn out, or unsolder the tin with which they come in contact. Within the cylinder, or case, and about six inches above the top of the first boiler, is placed a second boiler, set perpendicularly over the fire bed. The second boiler communicates with the first boiler by two, or more, tubes, placed at opposite sides, of about an inch diameter; and if there are enough of them to extend quite round the periphery of the boilers when placed an inch apart, except at the doorway, where the fuel is introduced, there will be an advantage arising from their exposing a large surface of metal and water to the action of the heat. The second boiler need only be about an inch think on the inside, and its circumference, or horizontal diameter, should be such as to leave a space of about an inch between the sides of the case of the stove, and the sides of the boiler. Between the hollow sided boiler and the boiler last described, an aperture is cut in the front part of the case, to which a door is adapted for introducing the fuel. This aperture may extend nearly half round the stove, its bottom being about on a level with the top of the lower boiler; and the top of the door way should be about two inches beneath the bottom of the second boiler. When the stove is in use, the door may be kept open, and thus give at once a sight of the fire and the advantage of its radient heat. Between the second boiler and the top of the cylinder, and as near the top as is practicable, the smoke is delivered by a pipe leading into a chimney, or other avenue for its escape, as in common stoves. The top of the case, or cylinder, may be closed by a lid of sheet iron, through which a tube, or several tubes, leading from the top of the second boiler, into the first steam receiver, ascend. Or the first steam receiver may rest upon and close the top of the cylinder. It will be well to have three, four, or more tubes, of about an inch in diameter, leading from the top of the second boiler into the lower steam receiver. These tubes may be placed at equal distances, near the periphery of the second boiler, and lead in a perpendicular direction into the first steam receiver. Or a single tube, of from two to four inches in diameter, may lead from the centre of the second boiler to the centre of the first steam receiver. A short tube, of about one inch in diameter, enters the lower boiler about an inch from the bottom; projects, horizontally, through the case about three inches, and is fitted with a cock for drawing off the water when it is wished to empty the boiler. A similar, but smaller tube, enters the steam receiver just above the fire line of the stove,

and near the bottom of said receiver, for the purpose of ascertaining when there is water in the stove in sufficient quantity for putting it in operation, without danger of unsoldering the tin, and for drawing off that water which is not necessary to prevent the tin work from being burned or unsoldered.

The steam receivers consist of several vessels of tin, or other suitable substance, (not copper, for the effluvia of that metal when heated is unwholesome,) placed perpendicularly over the boilers before described, with which, and also with each other, they communicate by steam tubes. The number and dimensions of the steam receivers should be proportioned to the size of the fire pot, boilers, and the cubic space which it is intended to warm. From actual experiment, I am induced to believe, that a cylinder, fire pot and boilers, fitted as above, would require about fifteen superficial feet of steam receivers to condense the steam generated in a cylinder, twelve inches in diameter and two feet in length, fitted with boilers and tubes as mentioned above; and this apparatus will be sufficient to warm about 3000 cubic feet of space, as stated above. The steam receivers may be of any shape which convenience, or fancy, may dictate, but it will be expedient to have them so placed and shaped that they may present a large surface in proportion to their capacity. The form which I have adopted, and which may perhaps be as eligible as any, is that of flat, circular vessels, each about $\frac{1}{2}$ inch thick, or perpendicular depth, and placed about three inches perpendicular height, one above the other, with a gradual decrease of horizontal diameter from the lowest upwards. For instance, suppose the lowest steam receiver to be about 15 inches horizontal diameter, and to rest on the top of the cylinder, or case, of the stove. The next steam receiver may be 14 inches horizontal diameter, placed three inches above the first, with which it communicates by three or more tubes, of about $1\frac{1}{2}$ inch diameter, placed about equi-distant, near the outside of the receivers. The next steam receiver may be placed 3 inches higher, and be 13 inches horizontal diameter, and so on until they are six in the whole, and the upper one is ten inches in horizontal diameter. These flat, circular vessels, are surmounted by a vessel resembling the frustrum of a hollow cone, placed three inches above the upper steam receiver, with which it communicates by a tube or tubes. This vessel may be large enough to hold about three quarts, and into this, water is poured to fill the boilers. It has a lid, or cover, similar to that of a common tea kettle, which is made to sit somewhat loosely in its place, so as to admit air by its sides, and thus prevent the steam receivers from collapsing by the pressure of the atmosphere when the steam condenses, and to admit a portion of the steam to escape when there is more generated than can be condensed by the steam receivers. A damper should be fitted to the smoke pipe, as in common stoves.

Although I have adopted the above mentioned form of construction in the steam stove, yet this may be varied indefinitely; and as the statute declares, that simply changing the form and proportions of

any machine shall not be deemed a discovery, I shall hold the unlicensed adoption of the principles of my stove, under any possible form or modification, to be a violation of my patent right.

The novelty of the invention consists in an easily portable apparatus, which presents a convenient mode of arresting the heat produced from combustion on its passage from the interior of the stove to the chimney, by exposing as large surfaces of water as is conveniently practicable to the action of the caloric, and distributing the latent heat of the steam thus created, where it is most wanted; and condensing and bringing it back to the boilers without the apparatus of valves, syphons, &c. heretofore thought necessary in heating apartments by steam.

Observations by the Patentee.

THE heat which is generated by the combustion of fuel, is either *combined* or *radiant.* Combined caloric is united with the smoke vapour and heated air which rise from the burning fuel; and in common stoves and fire places, nearly the whole of the combined caloric escapes by the smoke-pipe, or chimney, and is lost. Count Rumford asserted that the quantity of combined heat which thus escapes, is much more considerable, perhaps three times greater at least, than that which is sent off in rays. And yet, small as is the quantity of this radiant heat, it is the only part of the heat generated by the combustion of fuel burnt in an open fire place which is ever employed, or which can ever be employed, in heating a room. The metal and water contained in the apparatus above described, intercept and form reservoirs for this combined heat; a part of it is detained, and distributed from the lower part of the apparatus, and a part entering the steam receivers, presents extensive heated surfaces to the air of the room, by which it is speedily and effectually warmed. Water possesses the greatest capacity for heat of any known substance, whether it be compared with equal bulks, or weights. A gallon of water, heated to 212 degrees, contains at least 500 times as much heat as a gallon of air at the same temperature. Hence, a bottle of hot air for warming the feet, &c. would not be more than one five-hundredth part so efficacious as a bottle of hot water, of the same bulk and temperature. Besides, air, when heated, becomes specifically lighter than the air in its neighbourhood; of course has a tendency to ascend and carry its caloric with it to a higher position, where its heat is diffused without answering any good purpose in economy. And in common stoves, the air of the room which is warmed is vitiated by coming in contact with a surface of hot iron, often heated red hot, by which its mass is rendered less fit for respiration, and head ache and languor are induced. But in my steam and hot water stove no part of the apparatus is heated much, if any, above the temperature of boiling water, the small particles of dust which float in the air not being burnt, it remains fresh and uncontaminated.

That an apparatus for heating rooms by hot water and steam, which

is portable, and requires but little care or skill in its attendance, is *new*, as well as useful, may be made evident from the following passages quoted from the British writers who have published works on warming and ventilating rooms, &c.

In a work entitled "Practical and Descriptive Essays on the Economy of Fuel and the Management of Heat," by Robert Buchanan, p. 240, it is stated that "although in situations in which there is a steam-engine, or a regular supply of steam kept up for other purposes, it may be proper to use steam for warming buildings, yet, when that is not the case, unless a person can be appropriated to the sole purpose of attending on the boiler, I should hesitate to recommend it." It is likewise observed in Tredgold's "Treatise on Warming and Ventilating Rooms," &c. p. 19, "Wherever steam is employed, it should be under the direction of a person competent and willing to attend to it. For though, in such hands, it is perfectly safe and easily managed, it is by far too complicated to be trusted in the hands of careless and ignorant people." It is also observed in a treatise entitled "The Theory and Practice of Warming and Ventilating Public Buildings, Dwelling Houses, &c. by an Engineer," published in London, in 1825, that "it will seldom be found adviseable to use steam in warming dwelling houses, unless the establishment of servants is very numerous." My steam stove requires less attention than a common fire place. A small quantity of water (eight or ten quarts,) will answer for a whole winter, as the steam is condensed and brought back into the boiler. The apparatus is perfectly free from any danger of bursting or exploding, as the steam is not confined, nor its passage obstructed until it reaches the upper steam receiver, which is closed only by a lid, sitting as loosely as that of a common saucepan.

Among the advantages which a portable steam stove possesses over a common stove, may be numbered its security from communicating fire to the apartment in which it is placed, as the fire place is surrounded and surmounted by water. Moreover, the steam receivers furnish a series of shelves, standing one above another, on which plates, dishes of meat, &c. may be kept hot; or linen, vegetables, &c. &c. may be dried.

THOMAS G. FESSENDEN.

A, A, A, A, the cylinder enclosing the fire place. B, B, the first side boiler. C, fire pot. D, D, tubes leading from the side boiler to the steam receiver. E, second boiler. F, F, tubes leading from the second boiler to the first steam receiver. G, G, G, steam receivers. I, I, tubes leading from one receiver to another. K, K, cocks for drawing off the water. L, smoke pipe leading into a chimney.

Fig. 1. *Perspective view of the stove.*

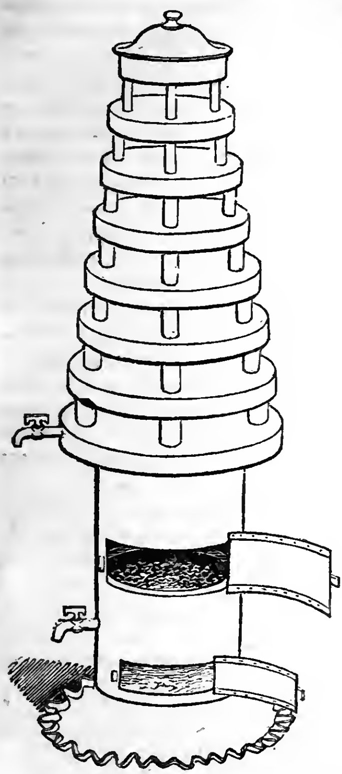
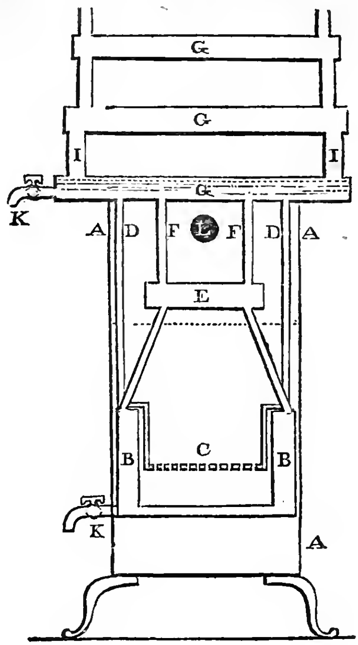


Fig. 2. *Section.*



Remarks by the Editor.—We have no doubt that the stove described in the foregoing specification, is a very good one, as regards the economy of heat, and the equable manner of its diffusion. Still a large portion of the heat extricated in the combustion of the fuel is liable to escape from this, as well as from most other stoves. The smoke pipe, L, leading into a chimney, must carry off both heated air and vapour, the *uncombined* heat of which must consequently be lost. If it is supposed that a stove of this description will absolutely give out more heat than one of the ordinary construction, this supposition is erroneous. The heat in a stove, or other fire place, is all extricated in the combustion of the fuel, and if, in a stove, the pipe is of sufficient length, and exposes a sufficient surface to the action of the atmosphere, to allow the heated air to become cooled nearly to the temperature of the room before it escapes into the chimney, all that the fire is capable of communicating is obtained. The use of steam in the way proposed, will not in the slightest degree increase this quantity, although it may diffuse it more equally than a stove ordinarily does.

We do not think that the "Observations by the Patentee," proceed, in the first instance, upon principles which are correct. "Combined caloric," he tells us, "is united with the smoke, vapour, and heated air, which rise from the burning fuel; and in common stoves nearly the whole of the combined caloric escapes by the smoke pipe, or chimney, and is lost," and we are left to infer that such is not the case with the stove in question. The watery vapour which arises from burning fuel may be condensed, and made to give out its combined caloric, and if the pipe be of sufficient length, as before remarked, the *uncombined* or free caloric of the *heated air*, may also be liberated; but such is not the case with its combined caloric. The combined caloric of smoke, spoken of by the patentee, is a species, or modification, of caloric, with which we are unacquainted.

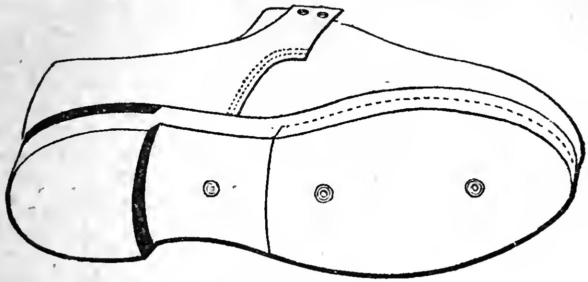
We think that the patentee has not chosen the proper place for his observations on the theoretical action, and the utility of his invention. These are matters which certainly do not belong to a specification. To us they appear as much out of place, as a disquisition upon the fertility of the soil, and the value of its products, would be in a deed of conveyance for a farm. In both cases, the metes and bounds are the proper subjects of description, in order that we may not lap over on our neighbour's property.

If such a disquisition is in place in a specification, there is nothing to prevent a patentee from writing a treatise upon the subject to which his patent relates, and sending it to the patent office to be engrossed upon parchment.

Specification of a Patent for an improvement in the mode of making or manufacturing Shoes and Boots, called the Farmer's double improved Boot and Shoe Sole. Granted to Moses Pennock, *East Marlborough, Chester county, Pennsylvania, December* 14, 1830.

The first lift of the heel of the boot or shoe, constructed at first in every other respect in the ordinary manner, is made to extend to that part of the shoe or boot which corresponds with the interior part of the hollow of the foot: that is to say, about two and a half inches beyond the heel forward towards the toe. To the top piece of the heel, as they are usually formed, an additional piece is then appended by as few nails or pegs as will serve to hold it firmly to its place. There is then fitted to the outer surface of that part of the sole which intervenes between the interior part of the extended lift of heel and the toe, a wearing sole, composed of a single thickness of sole leather, which is attached to the first mentioned sole by means of a sufficient number of nails, or pegs, driven at the distance of three-fourths of an inch, or an inch, apart, along its margin. Care should be taken in driving the pegs or nails, that they may escape the seams in the sole above.

Pennock's Farmer's Double Shoe.



Manner of Using.

When the outer sole and heel piece of a shoe or boot constructed in this manner are worn through, they may be replaced by others at a very small expense, and the superior heel piece and sole remain in as good wearing order as at first. The superior sole not being injured in its unexposed situation, may be used to great advantage as a wearing sole for new uppers after the first are worn out; and it is found by the experience of the inventor, to endure much longer than new and unseasoned leather. The outer sole and heel piece may be renewed at pleasure, as long as the uppers continue in good wearing condition.

MOSES PENNOCK.

Specification of a patent for an improvement in the art of Making and Curing Salted Beef, and particularly of the description called Jerked Beef. Granted to WILLIAM A. TOMLINSON, *city of New York, December 14th,* 1830.

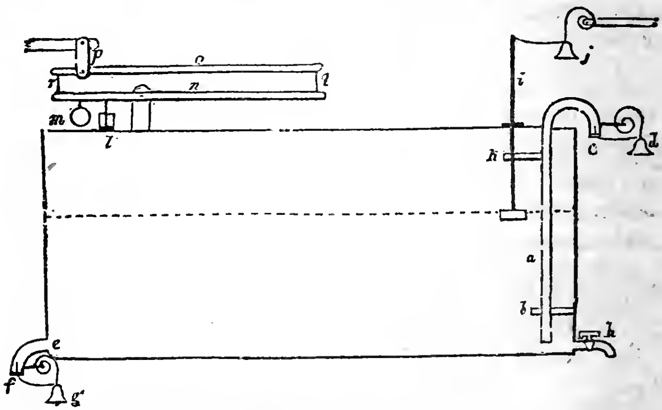
A ROOM, or building, of any description, intended to be used for the purpose, is to be warmed, or heated, by an open fire, or fires, or by a close stove, or stoves, or furnace, of any material or description, and the warm air allowed to circulate freely through it; and the beef being previously salted, or pickled, and cut in such form as best to receive benefit in drying, is to be placed in the room, or building, as above described, either by being suspended, or placed upon racks, or netting, or otherwise disposed, so as best to obtain benefit of the warm or heated air, and is thus to remain; its position to be changed if necessary, until it becomes sufficiently dried to keep; and may then be transported loose, or packed in boxes, or other packages, to any place for use: it is also a part of the process, when preferred, to furnish the room, or building, with windows, so as to admit the rays of the sun to aid the artificial heat or warmth in the drying process; or the beef may be alternately exposed to the artificial heat and the rays of the

sun, by removal from the room, or building, to the external, or open air, and returned again; and also *vice versa.*

The benefit to be obtained by the above process and its parts, in the making and curing salted beef, and particularly the advantage in the making and curing of jerked beef, over the mode hitherto practised for that article, (that mode consisting in drying the beef by exposure in the open air to the sun alone,) consist in drying the beef more uniformly and equally, gving it a better and sweeter flavour, and enabling it to be kept longer in any climate without spoiling; and is also a great saving in the expense and time of curing, as the drying goes on during any weather. The application of artificial heat, without the aid of smoke to the curing and preserving of salted beef, and particularly that description of salted beef usually called jerked beef, is a new invention and discovery, and is deemed an application of an *old* principle to a *new* purpose, of such importance as to be entitled to a patent. WM. A. TOMLINSON.

Specification of a patent for improvements in the making and constructing of Steam Engine Boilers. Granted to JOHN C. DOUGLAS, *city of New York, December 17th,* 1830.

J. C. Douglas' Steam Engine Boiler.



WHAT I claim as my specific improvements, consist, first, in having a pipe (*a*) of five inches diameter, near the furthermost end of the boilers, to go from the top to within two inches of the bottom, near which it is fastened by an iron stay (*b.*) The top of the pipe terminates with a vacuum valve, (*c*) having a bell (*d*) connected to it by a wire, for the purpose of notifying the Captain, or Pilot, of its motion.

Secondly. To insert in the front end of the boiler, at the height of two inches from the bottom thereof, another pipe of five inches diameter, (*e*) terminating with a vacuum valve, (*f*) having a bell (*g*)

annexed, (as with the first mentioned pipe,) to notify the engineer of its movement.

Thirdly. To have a water cock (*h*) in the front end of the boiler, at the height of two inches from the bottom thereof.

Should the engineer, on being notified by the ringing of the bell, (*g*) turn the cock, (*h*) he will find no water at the bottom of the boiler.

He must then damp the fire, open the safety valve, and, as soon as he finds water runs from the cock, (*h*) he may commence pumping into the boiler. (But if the cold water had been pumped into the boiler before the above preliminary steps were taken, it would cause the metal to have shrunk, and a rupture must have been the consequence.)

Fourthly. A floating water gauge, perforating the top of the boiler and indicating the number of inches of water therein, is formed of a hollow ball, with sufficient weight, just barely to immerse the ball in the water; attached to it is a polished piston rod, (*i*) which works through the stay, (*k*) and the *stuffed* box on the top of the boiler. A bell (*j*) connected with the piston rod by a chain, will give notice when the water has fallen to the level of the lowest water gauge.

In many instances the water-gauge-cocks, as they are now used, serve only to deceive the engineer; who, finding water to issue upon turning one of these cocks, naturally concludes that the water in the boiler is up to the height of that cock, while, in reality, it is several inches below it, (the water which issued from the cock being only the steam which had condensed in the tube.) The great pressure of the steam prevents the admission of the requisite supply of water, although the forcing pumps have put it in motion, and hence another cause of error.

Fifthly. A safety valve (*l*) having the weight (*m*) which the boiler is calculated to bear, suspended on its beam as usual, but the latter is extended beyond its fulcrum, (so as to form a lever of the first order,) and at the extremity of the longer arm (*n*) a chain (*g*) connects it with the end of the steelyard, (*o*) whose fulcrum (*p*) is raised a convenient distance above that of the safety valve beam. The shorter arm of the steelyard is then connected with the end of the beam on which the weight hangs, by means of the chain (*r*.) Now, whenever the steam begins to move the safety valve, it moves the other end of the beam down, which brings down also the corresponding end of the steelyard, and consequently, raises the other end with the safety valve beam on which the weight is hung, and the valve, being thus freed from the pressure of the weight, easily yields to the steam and lets it escape.

The steelyard can be so made that one pound of the pressure of steam can raise any weight necessary for the relief of the boiler.

In this last item, it is not the valve, but the appendages annexed thereto, as above set forth, that are claimed as the improvement; and which will render any boiler completely proof against any explosion, unless a greater weight on the safety valve beam is placed in the first instance, than the boiler is meant to bear. JOHN C. DOUGLAS.

Remarks by the patentee; prefixed to his specification.

I HAVE observed through the medium of the public prints, that the greatest number of the disasters which have happened to the boilers of our steam boats, have occurred after the water has been heated to that degree which has turned it into expansive steam.

If the valve is now open to allow the steam to escape, because the boat is not quite ready to go, or if the boat is stopped for any other purpose, the steam is generally let off when there is a pressure of twelve pounds, or upwards, on the beam of the safety valve; throwing open the valve thus suddenly gives the whole contents of the boiler a volatility somewhat resembling that of a well corked bottle of soda water when the cork is withdrawn, and the whole would be discharged in a second or two, were the aperture sufficiently large.

The moment the valve is opened, the whole fluid flies from the bottom of the boiler, and the great heat which is under the bottom makes it red hot in a few seconds, and generates a highly rarified air, which forms a vacuum under the steam.

Again, the valve is shut to give the steam power to operate on the engine, and the steam being now confined with the rarified air, a contest now takes place between them for the sole possession of the boiler; in a few minutes an awful explosion must take place, too often attended with death as well as destruction.

The engineer, just before the disaster took place, may have tried his gauge cocks and have found them all full of water, which must have been the case; for the rarified air had driven the whole contents to the surface of the boiler, but not one single drop remained at the bottom; the vacuum valve on the top of the boiler is of no manner of use when the above described disaster takes place, for the whole surface is occupied by the pressure of the steam which keeps the valve shut.

The only time this valve is of service, is, when the boiler is receiving a supply of water, which, by condensing the steam, forms a vacuum, which is filled through this means by the exterior atmosphere. JOHN C. DOUGLAS.

Remarks by the Editor.—We are unable to follow the patentee of the above described boiler, either in his theory or practice. We certainly accord with him in the first of his remarks, that an explosion rarely takes place in a boiler until "after the water has been heated to that degree which has turned into expansive steam." And if he is equally correct in all his assumptions, he is certainly the author of some notable discoveries; some in fact which must go far to revolutionize all the long cherished notions of philosophers on the subject of heat, air, and steam. It is a new discovery, that the rarified air at the bottom of a boiler will drive every drop of water to the upper part of it, and allow the bottom to become red hot. And unfortunately, the vacuum valve at the top, with its bell, will, in this case, be of no manner of use. It is a new discovery that the whole con-

tents of a boiler would fly off in a second or two, on opening the safety valve, were the opening sufficiently large. The terrible contest between steam and rarified air, to determine the question which shall have the sole possession of the apartment, is an event of which we had never before been informed. But we cannot pretend to notice all these important novelties, and the consequences to which they inevitably lead, as we have neither time nor space for the investigation.

Specification of a patent for an improvement in the mode of propelling spindles or machines for spinning wool. Granted to Russel Phelps, *Andover, Essex county, Massachusetts, December* 21, 1830.

In all the machines now used for spinning wool, which are called jacks, or billies, or jennies, the mode of propelling the spindles is by applying the power to one end, or the middle, of a cylinder, from which the spindles are successively banded.

My improvement consists in applying the power to both ends of the cylinder at once; and in order to produce this effect, I make a shaft of sufficient strength and length, to extend the whole length of the spinning frame, and attached thereto, on the back part of the frame; on each end of which shaft I secure a pulley, or wheel; to this wheel or pulley, I attach a band or belt, which, after passing over fixed pullies, in front of the machine, is strained over corresponding pullies, on each end of the cylinder which drives the spindles. This principal shaft is driven from the centre, or from any other point in its extension; and the effect of communicating motion from both ends of the shaft, to both ends of the cylinder, is to give a perfectly steady motion to the carriage, to which the cylinder is attached, and of necessity to the spindles connected therewith, and thus to produce better work; it also comes in aid of the squaring bands, in maintaining uniform motion. The great advantage derived from applying the moving power to both ends of the spinning frame, is, that by rendering the operation of the machine more easy and uniform, the number of the spindles may be multiplied to suit the convenience of the opeartor. In the jacks and billies commonly used in this country, one hundred and twenty spindles are the usual number attached to each frame; by the introduction of my improvement, double the number can be driven with equal ease, and without any additional skill on the part of the operator. Russel Phelps.

Specification of a patent for a new mode of manufacturing Spoons from tin plates, tin or pewter in sheets, sheet silver, or other metal. Granted to Robert Butcher, *of the city of Philadelphia, December* 27, 1830.

To all whom it may concern, be it known, that I, Robert Butcher, have invented a new mode of manufacturing spoons from tin

plates, tin or pewter in sheets, sheet silver, or other metal, by means of cutting and stamping presses, and that the following is a full and exact description of my said invention.

When I manufacture spoons of sheet tin, I usually employ that which is known as three or four cross. This I planish, or hammer, with a polished steel hammer, upon a polished steel anvil. This not only polishes the surface, but condenses the metal, and thereby renders it the more durable.

When I use rolled sheets of block tin, pewter, silver, or other metal, or mixture of metals, I generally polish such sheets on both sides before proceeding to make the same into spoons; this, however, is not essential to the process.

In order to make the above named, or other metallic plates into spoons, I first cut the metal into the exact form required, by means of a steel bed, and cutter, in the way well known to the workers in metal. Any of the screw, lever, or drop presses usually applied to such purposes may be employed.

The blank or flat pieces for spoons being thus prepared, they are raised by means of a drop, or fly press, or by any other adequate application of power. A die, with a metal forcer, being employed for this purpose.

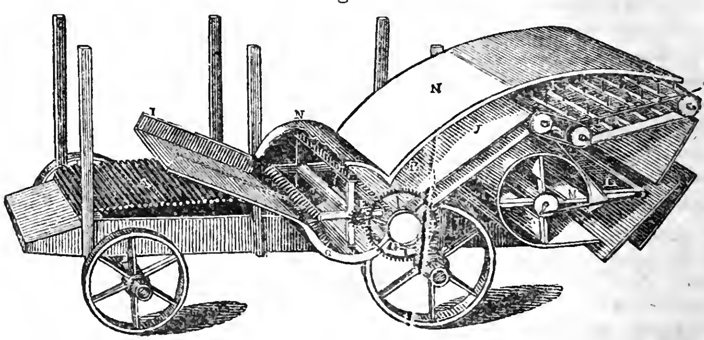
I do not claim to have invented any part of the machinery applied to this manufacture; but what I claim as new, is the manufacturing of spoons, without either casting or forging, by cutting and raising them out of sheet metal, in the way herein described; the same being a new manufacture.

Robert Butcher.

Specification of a patent for a machine for Thrashing and Cleaning Wheat and other grain. Granted to Samuel Lane, *Hallowell, Kennebeck county, Maine, April* 6, 1831.

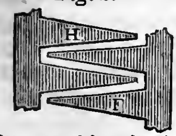
Lane's Thrashing and Winnowing Machine.

Fig. 1.



To all whom it may concern, be it known, that I, Samuel Lane, have invented certain improvements on the machine for thrashing

Fig. 2.



and cleaning wheat and other grain, which I denominate the portable horse power thrashing and cleaning machine, and that the following is a full and exact description of the said machine with my improvements thereon.

The power which I employ to drive my thrashing machine is the endless chain, and railway horse power, patented by me on the 17th of May, 1830. The mode of doing this, and likewise the general structure of the machine, is represented in the accompanying drawings.

A, Fig. 1, represents the inclined plane upon which the horse walks. B, a cog wheel on the end of the larger drum, over which the endless chain passes. This wheel may be 21 inches in diameter, and the pinion, C,* which it drives, 6 inches in diameter. The wheel, D, may also be 21 inches, and the pinion, E, on the shaft of the beaters, 6 inches; these relative proportions affording a sufficient velocity to the beaters.

The beaters have teeth, which may be made either of wrought or cast iron; they are to have, on their faces, the wedge-like, pointed, form seen at F, Fig. 2.

The hollow segment, G, is best made of cast iron. It is furnished with teeth of the same form and length with those on the beaters. The manner in which the teeth on the beaters pass those on the segment is shown at H, F, Fig. 2, where they are drawn of one-fourth of their usual size, and of the requisite space between them to allow the straw and grain to pass. The teeth I usually make upwards of two inches in length, as when shorter than this, the same quantity cannot be thrashed, there not being sufficient space. The pointed, or wedge-like, form of the teeth, their greater length than in other thrashing machines, and the space allowed between them for the straw, are essential features of my machine, and distinguish it from others which have been made to thrash by means of teeth.

The inclined board, I, is for the purpose of feeding. The straw and grain, after the thrashing is completed, are received upon an endless apron, J, passing over rollers. On this they are carried up to the endless sieve and rake, K. This sieve and rake are thus made—slats of wood, the length of the rollers, are attached to leathern straps, or bands, passing round the end of the rollers. These slats may be two or three inches apart, and they have wires projecting from their edges, forming a sieve. From the faces of the slats spikes project which form the rake to lay hold of the straw. The grain and chaff falls through upon a screen, L. To this screen a vibratory motion is given, from a crank on the shaft of the fan wheel, M, or in any other convenient way. The endless sieve, and the fan wheel, are driven by bands and whirls from the main machine. N, N, is a covering extending over the whole machinery.

It is manifest that this thrashing machine may be driven by other means than my patented horse power; I, however, deem this the most convenient.

* B and C are a wheel and pinion on the opposite end of the machine.

What I claim as my improvements are the particular form and arrangement of the teeth as described and represented; the receiving the grain and straw upon an endless apron, and thus carrying it up on the endless sieve and rake; the particular construction of the sieve and rake, and the general arrangement of the machinery by which these objects are effected.

Samuel Lane.

We have caused to be translated for the Journal the various ordinances, issued since 1823, of the French government in relation to high pressure steam engines. The ordinances are accompanied by circulars, explanatory of their details, and which emanate from different boards composed of officers of the corps of mines, and of government civil engineers, selected with reference to their peculiar qualifications for the task imposed. [Com. Pub.

Royal Ordinance of France, in relation to High Pressure Steam Engines, followed by instructions, and a Circular, on the same subject. 1823.

[TRANSLATED FOR THIS JOURNAL.]

Ordinance relating to High Pressure Steam Engines.

Art. 1. High pressure steam engines, those in which the elastic force of the steam exceeds two atmospheres, whether they consume their own smoke or not, cannot be set up except by virtue of authority obtained in conformity with the decree of 15th October, 1810, for establishments of the second class.

They will, besides, be subject to the following conditions, imposed in order to insure safety.

Art. 2. When authority for setting up such an engine is requested, the individual requesting authority must state at what degree of pressure the engine is to be worked.

Such pressure must not be exceeded.

The pressure must be stated in atmospheres, or in the number of pounds to each square inch of surface exposed to the pressure of the steam.

Art. 3. No high pressure boiler can be used unless it has been previously subjected to trial by the hydraulic press.

Every boiler must be proved at five times the pressure under which the engine supplied by it is to work.

Every boiler shall be marked after being proved, with a number, expressing the pressure under which it may be used, corresponding to the proof.

No individual shall use a boiler which is not marked with a number at least equal to that representing the pressure under which he has stated, in his declaration, that the boiler is to be used.

Art. 4. There shall be two safety-valves placed upon the top of every boiler, one at each end. The size and load of each shall be

the same, and must be regulated, the former by the size of the boiler, the latter by the degree of pressure indicated by the proof-mark: the size of either valve will be so regulated that if raised alone, it may be sufficient to discharge the steam accumulated within the boiler.

The first valve shall be under the control of the engineer or fireman.

The second must be preserved from such control by being inclosed in a grating, of which the proprietor of the works, where the engine is used, shall have the key.

Art. 5. There shall in addition to these valves, be adapted to the top of each boiler two metallic plates, fusible at temperatures hereinafter to be stated.

The first of an area at least equal to that of one of the safety valves, shall be made of an alloy which shall melt, or soften so much as to yield to pressure, at 10 degrees of the Centigade thermometer, (18°F.) above the temperature corresponding to the proof-mark upon the boiler.

The second of twice the area of the first, shall be placed near and inclosed by the same grating, with the first safety valve: it shall be made of an alloy which shall fuse, or soften, at 20° C. (36 F.) above the proof-mark.

These plates shall be stamped with a number showing the degree of the thermometer at which they fuse.

Art. 6. No boiler shall be placed in an inclosure of less than twenty-seven times the capacity of the boiler.

The inclosure must be lighted, on two sides at least, by windows, closed by light shutters, opening outwards. It must not be contiguous to the walls of adjacent buildings, from which it must be separated by a wall of at least three feet thick, distant not less than two yards from the building. It must be separated by a wall of the same thickness from any interior workshop. There must be neither dwelling nor workshop above the boiler house.

Art. 7. The engineers of mines resident in the several departments, or in their default the government civil engineers, are charged with superintending the proving of the boilers, and fusible plates. They will stamp the proof numbers upon them with dies, which are to be furnished them for that purpose.

These engineers shall satisfy themselves, by inspection, at least once every year, that all the conditions prescribed are rigorously observed. They must examine the boilers, ascertain their condition, and cause to be thrown out of use, those which long continued wear, or accidental deterioration, may have rendered dangerous.

The local police authorities will keep a constant watch over the works using high pressure engines.

In case of non-compliance with the present ordinance, the proprietors of the works will be subject to a stoppage of the works, without regard to the penalties, damages, &c. which may be awarded by the courts of justice.

Art. 8. Our minister of the interior will cause instructions to be

published, stating the precautions to be habitually observed in relation to high pressure engines.

These instructions must be posted up in the works.

Art. 9. Our minister of the interior is charged with the execution of this ordinance, which will be inserted in the Bulletin of Laws.

Given, &c. Oct. 29th, 1823.

[Signed,] LOUIS.

CORBIERE, *Minister of the Interior.*

Instructions relating to the precautions to be observed in the use of High Pressure Steam Engines.

THE use of high pressure engines requires constant care on the part of the engineers and firemen, and constant watchfulness on that of the proprietors. By neglecting the necessary precautions, the workmen may give rise to serious accidents, of which they themselves will be the first victims. By relaxing in vigilance the proprietors of the works may be the indirect cause of such accidents, besides exposing themselves to the losses which must result from the destruction of the engine, and to the injury which their business must suffer from the stoppage of work.

It is the duty of the proprietor to trust the direction of the engine to none but a man of tried intelligence and capacity, who is not only sober, and active, but who is also without any impediment to the regular discharge of his duty. Nothing should interfere with this regularity, nothing disturb or distract the attention of the engineer, otherwise there can be no security in the works.

The attention of the engineer and proprietor should be directed particularly to the following parts of the engine, viz: the furnace, the boiler, and boiler-tubes, the supply pipe, the level of the water within the boiler, the safety valves, the gauge. There are precautions to be taken also in relation to the inclosure containing the boiler.

The Furnace.

The principle according to which the heating should be regulated, is to avoid sudden changes of temperature, from cold to heat, or the reverse; in either case, the boiler is exposed to more or less considerable inequalities of temperature, which, on account of the variable expansions caused, may occasion cracks and leaks. Thus, on first getting up the steam, the fire should not be urged too much, particularly if the furnace has been entirely cold. Time would be gained only at the expense of the safety of the boiler. When the fire has been raised to a height adequate to supply steam for the working of the engine, it ought to be kept up uniformly; it should, therefore, be stirred at proper times, and supplied with just the requisite quantity of fuel, and no more. The fire must not be suffered to go down during the continuance of the work; and if this should happen, fuel must not be supplied hastily, and in great quantities; such a supply would at first produce a chilling effect, and afterwards give out an excessive and dangerous quantity of heat.

The stirring and replenishing should be performed quickly, so as

to abridge the destructive action, which the cold air, introduced through the furnace door, would otherwise have, upon the boiler.

These precautions are not required when the self-regulating apparatus for feeding the furnace with coal, is used; in such a case the fireman must see that the hopper is supplied with coal, and that the supply from it is uniform and continuous.

Putting out the fire, when not carefully performed, is one great cause of the accidents which happen to boilers. The best method is to leave the unburned part of the fuel in the furnace, to close the register in the chimney, as well as the door of the ash-pit, and to stop up the crevices of this door, as well as of the furnace door, with clay. By proceeding thus, the sudden cooling of the boiler, and the rapid oxidation of its exterior surface, are avoided. Besides, the unburned fuel is turned to account; for, not having a supply of air, it goes out, and may be readily withdrawn from the furnace when it has cooled.

Of the Boiler.

However pure, water may seem to be, it deposits an earthy sediment which should not be allowed to accumulate. This deposit rapidly hardens, and increasing in thickness, it prevents the ready access of heat to the water within the boiler: thus, to supply the engine with steam, the fire must be raised, fuel is wasted, and the danger of decay and of bursting is increased.

Experiment has shown, that if potatoes in proper quantities be introduced within the boiler, the deposit is for a time prevented, the fecula of the potatoes keeping in suspension, the earthy sediment; but the viscous matter thus formed, as it increases in thickness, hinders the evolution of steam, and a period arrives, when its removal is indispensable; this period depends upon the nature of the water used. The proprietors of the engine should determine, by experiment, the proper period for cleansing the boiler, and also the least possible quantity of potatoes, if used, which will produce the desired effect. These investigations are required, not only by a regard to safety, but to economy; since the action of the fecula will retard the production of steam.

If, notwithstanding every precaution, a boiler-tube* should crack, the engineer ought, at once, to inform the proprietor of the fact, and the latter should instantly replace the cracked tube by a new one. Patching the tube would only conceal the mischief, and the danger of explosion would be incurred.

The proprietor and engineer should observe, attentively, the oxidation of the surfaces of the generating tubes, particularly if they be of cast iron. If they find reason to suspect that any of their boiler tubes are defective, they should prove them anew without waiting for the visit of the inspecting engineer. The same remarks apply to boilers; but as the means of observation are not so frequent, the engineer and proprietor should seize every occasion to ascertain the condition of the boiler; when, for example, one or more of the

* The tubes here referred to, are those below the boiler in Woolf's engine.

generating tubes are to be replaced—when repairs are to be made to the covering of the boiler, or when it is emptied to be cleaned, the indications afforded by leaks, should be carefully attended to.

When a leak is found at the juncture of the boiler head with the boiler, or at the head of one of the generating tubes, no attempt should be made, while the engine is in action, to close the joint by tightening the screws; by so doing, a risk would be run of cracking the head; in the event of its giving way, the workman would be killed by the splinters, or scalded by the steam and hot water.

When the generating tubes, or boilers, are to be cleaned, the proprietors should not require their workmen to let off the water while yet hot, particularly when the boiler tubes have not stop-cocks attached to them.

Of the Supply Pump, and the level of the water within the Boiler.

When a float is used to show the level of the water within a boiler, it is of the greatest importance that the level should be kept at that indicated by the horizontal position of the lever, attached to the float. The engineer must not, however, trust entirely to the horizontal position of this lever, for information; he must satisfy himself that the motion of the float is perfectly free. He must especially be certain that the stuffing, through which the stem of the float passes steam-tight, does not press too closely upon the stem, preventing its free motion, and rendering inaccurate the indication afforded by the float.

The same precautions are necessary, when the float, by its depression, opens a valve through which water is supplied to the boiler as it is wanted.

The supply pump should be carefully attended to. If, from negligence, the level of the water within the boiler should become too low, as soon as it is ascertained, the supply should be gradually increased, otherwise accident may result. The water rising rapidly in contact with the sides of the boiler, which the fire may have heated, might produce so great a supply of steam, that the pressure would be too powerful for the boiler to withstand. The danger would be imminent if, in such a case, the safety valves were out of order, or overloaded.

If an explosion should not be produced by a defective supply of water, the least evil which could occur would be the fracture of the boiler.

Safety Valves.

In the engines where these valves are under the control of the fireman, he should study their play, and ascertain exactly what degree of adhesion they have to the valve seats. This adhesion must be attended to, even when the surface of contact is very small. The fireman should satisfy himself, by frequent trials, that these valves have the freedom of motion necessary to their perfect working. In order to this, he should raise, from time to time, the arm of the lever, to which is attached the constant weight with which the

valve is loaded, to ascertain that the valve has not acquired an adhesion to its seat.

When the valves do not move freely, and when the maximum load which they are to bear, is placed upon them, they can fulfil their object but imperfectly; they confine the steam which should be suffered to escape; it accumulates, and may perhaps acquire an elasticity greater than that which the boiler can resist. This fatal effect might also be produced, if, in order to work the engine more rapidly, a weight has been added to that which constitutes the proper load of the safety valve. To overload the safety valve is exceedingly dangerous; ignorance of the danger incurred would constitute the only excuse for a proprietor who should order such a thing to be done, or for the engineer who should execute such an order. The firemen ought to be well aware, that one of the chief effects of an explosion would be to allow the escape of an immense quantity of hot water and steam, which would cause their death, or inflict extreme suffering.

Such accidents are much less to be feared in engines established in conformity with the royal ordinance of October 29, 1823, but the safety valves should not the less be watched, and kept perfectly free. In fact, if their play were stopped, ever so little, it would happen, upon the least increase of the fire, that the steam, instead of escaping, would accumulate, increasing in both temperature and elasticity; it would, after a time, melt the fusible plates applied to the boiler, the working of the engine would be thus stopped, and the proprietor must incur the inconvenience of the delay incident to the replacing of this plate. The proprietor should specially visit every day the valve under the grating of which he has the key. The valves should be ground very frequently, otherwise they will suffer the steam to escape. The necessity of keeping them in order is imperative, for the workmen can only render them tight by increasing the load upon them, and the proprietor cannot too strictly prohibit their being overloaded.

When the fire is left to burn out, or when it is covered up, in order to be relighted the next day, the workshop should not be left, before it is ascertained that the safety valves are unloaded, so as to permit the steam, which is still produced to escape freely.

Of the Steam Gauge.

The gauge, being connected with the interior of the boiler, shows always the rate at which steam is generated, and the degree of pressure produced by it. The variation of pressure is shown by the motion of the mercurial column in the glass tube, and the amount is measured by the scale attached to this tube.

This instrument, when properly constructed, is of the greatest utility: to preserve it from accident, it should be enclosed in an iron, or brass, wire grating.

The proprietor should ascertain that his engine-men are duly sensible of the advantages of this instrument, and understand the manner of using it.

It is the duty of the fireman to consult the gauge very frequently, and to be guided by its indications in regulating the fire, whatever may be the resistance, arising from the work to be done, against which the machine is acting.

Of the Inclosure containing the Engine.

In order to render the effects of explosion, should such accidentally occur, less dangerous, the boiler-house must be completely insulated. The materials stored in the works should not be deposited within several yards of it. The proprietor would violate the 6th art. of the royal ordinance of Oct. 29, 1823, if he should fill the space between the neighbouring buildings and the wall about the boiler-house, with resisting materials. This wall cannot answer the purpose of that ordinance unless it has an open space around it.

Finally, it is indispensably necessary that the boiler-house should be kept under lock, so that, in the absence of the fireman, no one can have access to it. We may imagine that if the safety valves should be overloaded, or kept down by wedging, after the fire has been covered up, the accumulation of steam might occasion an accident; precaution is as necessary in this case as in those dwelt upon above. The superintending care of the proprietor, and the vigilance of the engineer, should never be wanting at any time or under any circumstances.

(Signed,) Becquey,

Counsellor of State, and Director General of Civil Works and Mines.

Paris, 9th March, 1824.

Circular of April 1st, 1824, to the Prefects of Departments.

Sir,—You have been made acquainted with the royal ordinance of October 29th, 1823, relating to high pressure engines. According to the 8th art. of that ordinance, the instructions in reference to the precautions to be observed in the use of these engines, must be printed and posted up in the workshops.

The engineers of mines of the department, or, in their default, the government civil engineers, having been charged, by art. 7, with executing the principal parts of that ordinance, I assembled a board, composed of those members of both corps best acquainted with the subjects committed to them, and requested them to prepare a set of instructions in relation to the measures of precaution to be habitually observed, in the use of the high pressure engine. These instructions were approved on the 19th of last March, by his excellency, the minister of the interior.

I have the honour to transmit — copies. You will please to have the instructions printed, and posted up in workshops where there are engines, which come under the terms of the first art. of the ordinance of October 29th.

You will also transmit copies to the proprietors of engines, re-

questing them to make abridged extracts from them, applicable to the kind of engine which they use.

I am now preparing materials for a second set of instructions, in relation to the execution of the 3d, 4th, and 5th articles of the ordinance; these articles refer to the proof to which the boilers must be subjected, to the valves to be applied to each end of the top of the boiler, and to the two fusible plates intended to prevent explosions.

I shall have dies made, to be sent to the engineers whose duty it is to have marked upon every boiler, the degree of pressure with which it has been calculated to work, and according to which the proof has been made, as also, the temperature at which the metal plates attached to the boiler are fusible.

Under existing circumstances, to secure manufacturers as much as possible from accident, I beg you to attend at once to the execution of art. 6th of the ordinance, according to which a boiler must not be placed in an enclosure of less than twenty-seven times the capacity of the boiler.

The enclosure must be lighted on two sides at least, by windows closed by light shutters opening outward. It must not be contiguous to the walls of adjacent buildings, from which it must be separated by a wall of at least three feet thick, distant two yards from the building. It must be separated by a wall of the same thickness from any interior workshop. There must be neither dwelling nor workshop above the boiler-house.

I shall have the honour to transmit hereafter to you, and to the engineers of mines, and civil engineers, new instructions in relation to the valves, the fusible plates, and the application of the dies, &c.

(Signed,) Becquey,

Counsellor of State, and Director General of Civil Works and Mines.

On the Disease, called Painter's Colic, to which certain Trades are liable.

We have extracted from the valuable work on Poisons, by Dr. Christison, of Edinburgh, an account of the disease, known as the painter's colic, to which certain trades are liable. The article contains a plain statement of the causes producing the complaint, and of the precautions necessary to prevent their action.

Dr. Christison commences with some observations on the various ways in which lead enters the system, which we do not think it necessary to extract, and then proceeds to make the following remarks on the trades which expose workmen to its influence.

[Com. Pub.

The most accurate information on this subject is contained in the work of Mérat. He places foremost in the list, miners of lead. In this country miners are now rarely affected, because the frequency of colica pictonum [painter's colic] among them formerly, lead their masters to study the subject, and to employ proper precautions for

removing the danger. It has been stated by Dr. Percival, and is generally thought, that the whole of the workmen in lead mines are apt to be attacked with the colic,—those who dig the sulphuret, as well as those who roast the ore.* If this idea were correct, it would be in contradiction with the general principle in toxicology, that the metals are not poisonous unless oxidated. But the opinion is in all probability founded on error; for I am informed by *Mr. Braid*, who was some years surgeon at Leadhills in Lanarkshire, that the workmen who dig and pulverize the ore there, although liable to various diseases connected with their profession, and particularly to pectoral complaints, never have the lead colic until they also work at the smelting furnaces. Next to miners may be ranked manufacturers of litharge, red lead, and white lead. The workmen at these manufactories are exposed to inhale the fumes from the furnaces, or the dust from the pulverizing mills. It is chiefly among the workmen of a white lead manufactory in the neighbourhood of Edinburgh that I have had an opportunity of witnessing the lead colic. By a simple change the proprietor lately made in the process, and which will be mentioned presently, the disease has been almost extirpated.

Next in order, perhaps among the same class with colour-makers, are house painters. The cause of their liability is the great quantity of the preparations of lead contained in the paints they use. It would appear that lead colic is most frequent among people of that trade in cities of the largest size. In Geneva, I am informed by my friend *Dr. C. Coindet* of that place, colica pictonum is now almost unknown, and never occurs among painters. In Edinburgh it is also little known among painters. A journeyman painter, a patient of mine in the infirmary, had been seventeen years in the trade, and yet did not know what the painter's colic, or lead palsy, meant. In London, according to the dispensary reports, and in Paris, according to the tables of Mérat, many workmen of the trade suffer. I have been informed by an intelligent workman, once a patient of mine, who had been a journeyman painter both in London and in Edinburgh, that the number of his acquaintances who had been affected with the colic in the metropolis was incomparably greater than here. This man ascribed the difference to the working hours being more in the former place, so that the men had not leisure enough to make it worth their while to clean themselves carefully in the intervals. This appears a very rational explanation. I do not know how the great prevalence of colic among painters in Paris is to be accounted for. Plumbers, sheet-lead manufacturers, and lead pipe makers, are also, for obvious reasons, apt to suffer, but as they are not necessarily exposed to the vapours of lead, and suffer only in consequence of handling it in the metallic form, it ought to be an easy matter to protect them. They themselves conceive that a very hazardous part of their occupation is the removing of the melted lead from the melting pot to make the sheets or pipes; but this operation is not dangerous if the melting pots are properly constructed. A few cases of lead colic occur among glass-blowers, glaziers, and potters, who use the oxide of lead in their

* On the Poison of Lead, p. 22.

respective manufactures. There are a few also among lapidaries, and others, who use it for grinding and polishing stones or metals, and among grocers and colourmen who sell its various preparations. Printers are rarely attacked with the colic, but they are generally considered to be subject to partial palsy of the hands, which is ascribed to the frequent handling of the types. I have met with one case apparently of this nature. Lead is not the only metal to which the power of inducing colica pictonum has been ascribed. *Mérat* has mentioned several instances of the disease occurring among brass-founders and other artisans who work with copper.* *Tronchin* quotes Scheuchzer for a set of well-marked cases which happened in a convent of monks, and where the malady was supposed to have been traced to all the utensils for preparing and keeping their food, having been made of untinned copper.† The same author mentions two cases, one of which came under his immediate notice, where the apparent cause was the long-continued use of antimonial preparations internally.‡ Mérat has likewise found a few iron-smiths and white-iron-smiths in the list kept at one of the Parisian hospitals.§ Cases of colica pictonum have even been noticed by Mérat among varnishers, plasterers, quarrymen, stone hewers, marble workers, statuaries, saltpetre makers;‖ and Tronchin enumerates among its causes the immoderate use of acid wine or of cider, checked perspiration, sea scurvy, melancholy. But the only substance besides lead, whose operation in producing colica pictonum has been traced with any degree of probability, is copper; and even among those artisans who work with copper the disease is very rare. As to the other tradesmen mentioned by Mérat, it is so very rare among them, that we may safely impute it, when it does occur, to some other cause besides what the trade of the individual exposes him to; and in general the secret introduction of lead into the body, may be presumed to be the real origin of his malady. Still, however, the connexion of colica pictonum with other causes besides the poison of lead, is upheld by so many facts, and is believed by so many authorities, that this disease cannot be safely assumed, even in its most characteristic form, as supplying undoubted evidence of the introduction of lead into the system.

The work of Mérat contains some interesting numerical documents, illustrative of the trades which expose artisans to colica pictonum. They are derived from the lists kept at the hospital of La Charitè in Paris, during the years 1776 and 1811. The total number of cases of colica pictonum in both years was 279. Of these 241 were artisans, whose trades exposed them to the poison of lead, namely, 148 painters, 28 plumbers, 16 potters, 15 porcelain-makers, 12 lapidaries, 9 colour-grinders, 3 glass-blowers, 2 glaziers, 2 toy-men, 2 shoemakers, a printer, a lead-miner, a leaf-beater, a shot manufacturer. Of the remainder, 17 belonged to trades in which

* De la Colique Metallique.

† De Colica Pictonum, p. 56.

‡ De Colica Pictonum, p. 65.

§ De la Colique Metallique, p. 23.

‖ De la Colique, Passim.

they were exposed to copper, namely, 7 button-makers, 5 brass founders, 4 brasiers, and a copper-turner. The remaining twenty-one were tradesmen, who worked little, if at all, with either metal, namely, 4 varnishers, 2 gilders, 2 locksmiths, a hatter, a saltpetre-maker, a wine-grocer, a vine-dresser, a labourer, a distiller, a hatter, a stone-cutter, a calciner,* a soldier, a house servant, a waiter, and an attorney's clerk. Age or youth seems not to afford any protection against the poison. Of the 279 cases, 24 were under 20, and among these were several painter-boys, not above fifteen years old; 113 were between nineteen and thirty; 66 between twenty-nine and forty; 38 between thirty-nine and fifty; 28 between forty-nine and sixty; and 10 older than sixty. These proportions will correspond pretty nearly with the relative number of workmen of similar ages. Among the 279 cases, fifteen died, or 5.4 per cent.

* * * * *

The mode of preventing the influence of the poison becomes a subject of great importance; and more particularly when we consider the vast number of workmen in different trades, whose safety it is calculated to secure.

On this subject many useful instructions are laid down in the work of *Mérat*. He very properly sets out with insisting on the utmost regard being paid to cleanliness,—a point too much neglected by most artisans, and neglected particularly by those to whom it is most necessary, the artisans who work with the metals. In proof of the importance of this rule he observes, he knew a potter who contracted the lead colic early in life, when he was accustomed to go about very dirty, but for thirty years after had not any return of it, in consequence simply, of a scrupulous attention to cleanliness. In order to secure a due degree of cleanliness, three points should be attended to. In the first place the face and hands should be washed once a day at all events, the mouth well rinsed and the hair occasionally combed. Secondly, frequent bathing is of great consequence, both with a view to cleanliness and as a general tonic; so that masters should make it an object to provide their workmen with sufficient means and opportunities for practising it. Lastly, the working clothes should be made, not of woollen, but of strong, compact linen, should be changed and washed at least once, and still better twice, a week, and should be worn as little as possible out of the workshop. While at work a cap of some light impervious material should always be worn.

Next to cleanliness, the most important article of the general prophylaxis, relates to the means to be employed for preventing the food of the workmen from being impregnated with lead. For this end it is essential that they never take their meals in the workshop, and that before eating they wash the lips and hands with soap and water, and brush out all particles of dirt which may have lodged under the nails. It is also of some moment that they breakfast before going to work in the morning.

Derangements of the digestive organs should be watched with

* *Calcineur*,—a calciner of gypsum, I believe.

great care. If they appear to arise from the poison of lead, the individual should, with the very first symptom, leave off working and take a laxative. Habitual constipation should be provided against.

The nature of the diet of the workmen is of some consequence. It should be as far as possible of a nutritive and digestible kind. There is some reason for believing that the free use of fat and fatty articles of food is a preservative. *Dehaën* was told by the proprietor and physician of a lead mine in Styria, that the work people were once very liable to colic and palsy, but that, after they were told by a quack doctor to eat a good deal of fat, especially at breakfast, they were exempt from these diseases for three years.* Another fact of the kind was communicated to *Sir George Baker*, by a physician at Osterhoüt, near Breda. The village used to be the residence of a great number of potters, among whom he did not witness a single case of lead colic in the course of fifteen years, and he attributes their immunity to their having lived much on cheese, butter, bacon, and other fatty kinds of food.† Mr. Wilson says, in his account of the colic at Lead-hills, in Lanarkshire, that English workmen, who live much on fat meat, suffer less than Scotchmen, who do not.‡

Some have likewise proposed, as an additional preservative, that the exposed parts of the body should be anointed with oily or fatty matters. But *Mérat* maintains with some reason, that the lead will be thereby enabled to penetrate the cuticle more easily by friction and pressure.

The observance of the preceding rules will depend, of course, in a great measure, on the intelligence and docility of the workmen, directed by the vigilance and authority of their masters.

Some other objects, also of much consequence, are to be attained by the humanity and skill of the masters only.

The workshop should be spacious, and both thoroughly and systematically ventilated; the external air being freely admitted when the weather will allow, and particular currents being established, by which floating particles are carried through the workshop in certain invariable and known courses. Miners, and others who work at furnaces in which lead is smelted, fused, or oxidated, should be protected by a strong draught through the furnaces. Mr. Braid informs me, that wherever furnaces of such a construction have been built at Lead-hills, the colic has disappeared, while it continues to recur where furnaces are still used of the old, low-chimneyed, form. Manufacturers of litharge and red lead, used formerly to suffer much in consequence of the furnaces being so constructed, as to compel them to inhale the fine dust of the oxides. In drawing the furnaces the hot material is raked out upon the floor, which is two or three feet below the aperture in the furnace; and the finer particles are

* Ratio Medendi, p. 1. c. 9. de Variis.
† Trans. of London Coll. of Phys. 2. 457.
‡ Ed. Phys. and Lit. Ess. 1. 521.

therefore driven up and diffused through the apartment. But this obvious danger is now completely averted by a subsidiary chimney, which rises in front of the drawing aperture, and through which there is a strong current of air attracted from the apartment, the hot material on the ground performing the part of a fire.

In white lead manufactories a very important and simple improvement has been effected of late, in some places, by abandoning the practice of dry grinding. In all manufactories of the kind, the ultimate pulverizing of the white lead has been long performed under water. But in general, the preparatory process of rolling, by which the carbonate is separated from the sheets of lead on which it is formed, continues to be executed dry. This is a very dangerous operation, because the workmen must inhale a great deal of the fine dust of the carbonate. In an extensive white lead manufactory at Portobello, the process is entirely performed under water, or with damping; and to this precaution, in a great measure, are imputed the improvement which has taken place in the health of the workmen, and their superior immunity from disease, over those of Hull and other places, where I am informed the same precaution is not taken.

The only operation now considered dangerous at the Portobello works, is the emptying of the drying stove, and the packing of the white lead in barrels; and the dust which is then diffused is kept down as much as possible, by the floor being maintained constantly damp. By these precautions, and by care being taken to make the workmen wash their hands and faces before leaving the works for their meals, and to administer a brisk dose of castor oil on the first appearance of any complaint of the stomach or bowels, the manufacturer succeeded in extirpating the colica pictonum entirely for several years. Last year it appeared again to a limited extent among the work people, apparently in consequence of the rules as to cleanliness, not having been so carefully enforced.

Remarks on the Different Modes of Applying power for Locomotive Purposes.

(Concluded from page 262.)

Before leaving the subject, it may not be reckoned improper to estimate the facilities which the condensed air system affords to locomotion on common roads. It has already been observed, that the various inconveniences and obstacles which present themselves in regulating the supply of steam power to meet an ever-varying opposing force have, as yet, entirely prevented its effectual application on common roads. By applying a reservoir of condensed air, however, and the necessary apparatus of communication, this hinderance is removed, and in every case of expenditure the greatest economy is introduced. To gain a complete knowledge of its expediency, it therefore only remains to have an accurate notion of the additional weight of the reservoir and machinery requisite to retain, with most perfect safety, the necessary quantity of power. To avoid circumlocution, these several advantages may be conveniently displayed in the form of a table, which is arranged in the following manner:—

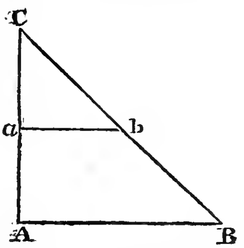
1	2	3	4	5	6
Height of Ascent.	Contents of Reservoir in Cubic feet.	Diameter of Reservoir in Feet.	Thickness of Reservoir in Inches.	Weight of Reservoir in lbs. Avoird.	Horizontal Length in Miles.
0	65.710	4.035	.605	1238	10.000
50	66.954	4.061	.609	1262	10.189
100	68.198	4.086	.613	1287	10.379
150	69.442	4.110	.616	1311	10.668
200	70.686	4.135	.620	1336	10.758
250	71.930	4.160	.624	1360	10.947
300	73.174	4.183	.627	1384	11.137
350	74.418	4.204	.631	1408	11.326
400	75.662	4.228	.634	1432	11.516
450	76.906	4.252	.638	1455	11.705
500	78.150	4.277	.641	1477	11.896
550	79.394	4.298	.645	1499	12.084
600	80.638	4.320	.648	1520	12.274
800	85.614	4.408	.661	1615	13.032
1000	90.590	4.491	.674	1709	13.790
1500	103.030	4.688	.703	1936	15.685
2000	115.470	4.870	.730	2176	17.580
2357	124.352	5.000	.750	2356	18.932

The first column presents the height in feet which has to be overcome, and is equal to the sum of the height of all the inclinations of ascent, which is gone over in the horizontal distance of 10 miles. The second shows the number of cubic feet of air, having 50 atmospheres' condensation contained in the reservoir, being 5 times the quantity of power necessary to impel the loaded coach, reservoir, and machinery, estimated at 6 tons, over a horizontal distance of 10 miles (the force of traction being estimated at $\frac{1}{20}$ the whole load,) and up ascending inclinations, the sum of the vertical heights of which are considered variable, and denoted by the figures in the first column. The quantities in this column are calculated from the formula $SW=\frac{15\ A^2\ C}{2}$, already explained and demonstrated. The third column shows the corresponding diameters of the reservoir, considered as a spherical shell. The fourth column shows the requisite thickness of the reservoir—supposed to be malleable iron—having a cohesive force of 75,000 lbs. to the square inch, one-fifth of which being taken as the quantity M in the formula $t=\frac{pD}{4M}$ (see note A,) from which the figures in this column were calculated. The fifth column represents the corresponding weight of the reservoir, a cubic foot of the iron being supposed to weigh 480 lbs; the formula being $\frac{480 \times 3.1416 \times D^2 t}{1728}=D^2 t \times .873=$weight in lbs. The figures in the sixth or last column, represent the respective distances to which the coach would proceed on a level road, having a reservoir with dimensions, &c. as specified in the foregoing columns.

This table appears to show satisfactory evidence of the practica-

bility of this system on common roads, and the only difficulty which can remain to lead to different conclusions is the uncertainty of an efficient mode for the direct application of the power. If this were discovered, and all the practical difficulties removed, it must be encouraging to reflect that a coach, weighing 6 tons, including a reservoir of condensed air, 5 feet in diameter, and weighing one ton, could move at almost any velocity over a distance of 17 miles, and ascend inclinations having a total vertical height of 1500 feet. (Note B.)

(Note B.)—To the great velocity to which locomotive steam carriages aspire, the resistance of the air must prove a serious obstacle. Of late a speed of 40 or 50 miles an hour is said to have been attempted—it will be interesting to calculate the exact amount of this resistance. A body descending by the force of gravity continually receives new impressions, equal in equal times, which introduces an equably accelerated velocity. This velocity continually increasing, may be represented by one side, AB, of a triangle, whilst the other side,



AC, may represent the time elapsed since the commencement of the motion, which likewise undergoing a simultaneous increase, AB will always be proportional to AC. In ascertaining the resistance of air, the pressure of this resistance is to be compared with the force of gravitation. With regard to the former we have to observe, that the velocity being uniform, the quantity of matter varies; let AC, in this instance again, represent the time, and AB the distance gone over in this time, or the quantity of air which impinges against the carriage. It is evident, that in a small instant *a*C the velocity being uniform, the quantity of air which has impinged during the lapse of this instant is proportional to *a*C, and may be represented by *ab*, which is to *a*C::AB.AC. In gravitation, therefore, the quantity of matter is constant, the velocity increasing with the time, whilst in the resistance of air or any other fluid the velocity is constant whilst the matter augments with the time. If then in equal time AC.AC, the two products AB.AC, AB.AC, are equal, the pressure and resistance mutually balancing each other, an equilibrium will take place. This may be understood likewise from considering that momentum of every kind is compounded of the velocity of the moving body, and the quantity of matter which is in this body, both being equally necessary to the production of motion, if in one case the velocity augments whilst the quantity of matter is constant, the resulting momenta are the same as if the quantity of matter increased in an equal ratio and the velocity remained constant. To illustrate this by a practical example, we may attempt by this method to calculate the resistance of a square foot of surface moving in air at the velocity of 30 miles an hour. Assuming the specific gravity of air as ·0012, water being 1, and a cubic foot of it weighing $62\frac{1}{2}$ lbs. the distance moved over in a second will be $\frac{30\times5280}{3600}=1.47\times30=44$ feet, and the quantity of matter impinging in that time $=44\times.0012\times62.5=3.3$ lbs. the product of this quantity by 44 (or the velocity,) and divided by 32 17 (the force of gravity) will give the number of pounds pressure on the square foot, or $\frac{44\times3.3}{32{\cdot}17}=4.536$ lbs. In this manner, A representing the velocity in miles per hour, we obtain the formula $\frac{\left(\frac{A\ 5280}{3600}\right)^2 .075}{32.166}=.00504\ A^2$ lbs. = the pressure on a square foot of surface moving in air at the rate of A miles an hour.—See Table in the following page.

Surely such conclusions afford the greatest encouragement for a practical trial of the system; and if found to succeed, the advantages to be derived from its application must prove incalculable. The steam-engine would acquire double value and efficacy, and, from its superior economy and convenience, might tend to abridge, and finally abolish, every description of animal labour. Altogether, the subject, however much at present it wants the aid of practical experience, is not unworthy of public attention, and from the eminent good which is likely to spring from it, seems well calculated to excite the efforts of ingenious and enterprising engineers. The object of the foregoing remarks has chiefly been to rouse the attention of your correspondents to the subject. A patent has been taken out by a gentleman in Wales for this mode of stowing and applying power, but not having heard of its having, as yet, undergone any experimental trial, it would be highly interesting if any of your readers could supply any information upon this subject, and would much oblige, sir, your obedient servant,

Edinburgh, *Nov.* 1830. N. S. N.

Miles per Hour.	Square feet of opposing resistance.										
	1	4	8	12	16	20	24	28	32	36	40
1	.00504	.02016	.04032	.06048	.08064	.10080	.12096	.14112	.16128	.18144	.29160
5	.126	.504	1.008	1.512	2.016	2.520	3.024	3.528	4.032	4.536	5.040
10	.504	2.016	4.032	6.048	8.064	10.080	12.096	.14112	16.128	18.144	20.160
15	1.134	4.536	9.072	13.608	18.14	22.68	27.22	31.75	36.29	40.82	45.36
20	2.016	8.064	16.13	24.19	32.26	40.32	48.38	56.45	64.51	72.58	80.64
25	3.150	12.60	25.20	37.80	50.40	63.00	75.60	88.20	100.8	113.4	126.0
30	4.536	18.14	36.29	54.43	72.58	90.72	108.86	127.01	145.15	163.30	181.4
35	6.174	24.70	49.39	74.09	98.78	123.5	148.2	172.9	197.6	222.3	247.0
40	8.064	32.26	64.51	96.77	12982	161.28	193.54	225.8	258.1	290.3	322.6
45	10.21	40.8	81.65	122.47	163.3	204.1	245.0	285.8	326.6	367.4	408.2
50	12.60	50.4	100.8	151.2	201.6	252.	302.4	352.8	403.2	453.6	504.0

[*Mechanics' Magazine.*

To our Readers.

We are promised that a further portion of the Report of the Committee on Water Power will be in readiness to present to our readers in the number for June next: the nature of the calculations must necessarily produce intervals between the appearance of the different parts of this Report.

COMMITTEE ON PUBLICATIONS.

Meteorological Observations for March, 1831.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2, P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain and snow.	State of the weather, and Remarks.
				Inches	Inches.			Inches.	
	1	30°	54°	30.15	30.15	W. W.	Calm.		Clear. Clear.
	2	38	58	.26	29.95	W. S.	do.	.02	Clear—*river open*—rain.
	3	46	54	29.93	.83	W. W.	Moderate.		Clear. Cloudy.
	4	34	48	.90	.92	W. SW.	do.		Clear. Cloudy.
	5	44	62	.80	.85	W. W.	do.	.19	Cl'dy-cl'dy-rain in night.
☾	6	48	43	.85	.84	S. S.	do.	.17	Cloudy—cloudy—rain.
	7	39	49	.70	.70	SW. W.	Blustering.	.01	Fog—flying clouds—rain.
	8	30	43	.90	30.00	W. W.	Moderate.		Clear—flying clouds.
	9	30	50	.95	29.80	S. S.	do.	.01	Cl'dy—clear—slight rain.
	10	32	44	.80	.85	W. W.	do.		Clear. Clear.
	11	29	50	30.00	30.00	SE. S.	do.		Clear—white frost—clear.
	12	37	58	29.80	29.70	SW. S.	do.		Cloudy. Cloudy.
	13	32	52	.53	.50	W. W.	Blustering.		White frost-fog-fly. cl'ds.
⊗	14	32	42	.65	.75	do.	do.		Clear—flying clouds.
	15	31	56	.75	.83	do.	Moderate.		Clear. Clear.
	16	48	48	.65	.65	SW. W.	do.		Cloudy cloudy—drizzle,
	17	34	26	.60	.60	SE. NW.	Blustering.	.16	Cloudy—snow squall.
	18	20	38	30.20	30.20	W. SW.	Moderate.		Clear. Clear.
	19	34	43	29.74	29.60	S. W.	Blustering.	.20	Rain—flying clouds.
☽	20	29	38	.72	.83	W. W.	do.		Clear. Clear.
	21	23	43	30.15	30.25	do.	Moderate.		Clear. Clear.
	22	29	54	.25	.25	do.	do.		Clear—white frost—clear—
	23	39	63	.15	.15	SW. S.	do.		Cloudy—hazy. [lun. halo.
	24	49	60	.09	29.90	S. S.	do.	.35	Rain—thunder shower.
	25	56	64	29.63	.63	W. W.	do.		Flying cl'ds—flying cl'ds.
	26	48	62	.70	.70	W. SW.	do.		Clear. Clear.
	27	47	64	.60	.60	S. W.	Blustering.	.66	Clear. Clear.
🌝	28	44	54	.90	.95	N. NE.	Moderate.		Clear. Overcast.
	29	41	44	.90	.80	E. SE.	do.		Rain. Rain.
	30	47	48	.40	.25	SW. W.	Blustering.	1.30	Fog—rain—cloudy.
	31	41	68	.70	.60	SW. S.	do.	.04	Clear—clear—shower in the evening.
	Mean	37.45	50.96	29.85	29.83			3.11	

	Thermometer.	Barometer.
Maximum height during the month,	68. on the 31st	30.26 on the 2nd.
Minimum do. . .	20. on the 18th, . .	29.25 on the 30th.
Mean do. . . .	44.20	29.84
Water fallen in snow and rain,	3.11 inches.	

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

MAY, 1831.

Remarks on the effect of Salt Water in Steam Engine Boilers, and on some other points relating to their structure and use: extracted from a letter to the Editor, written by a gentleman in Boston.

THE Committee of the Franklin Institute having expressed a desire to have information of any facts connected with the causes of explosion in boilers, I offer the following, which, although not an instance of explosion, is connected with the subject. A boat was repaired in this place to ply about the harbour. A new boiler of nearly ¼ inch iron was put into it; the fireman soon began to complain that he could not keep up the steam, and the difficulty increased until it was found impossible to raise power enough to drive the boat more than three or four knots an hour, although the furnace was abundantly supplied with fuel, which was thoroughly ignited. At length the boiler began to leak in such quantity as to extinguish the fire, a large rent having been made in the bottom of it. It was found that the part immediately exposed to the flame had bilged outwards, and it appeared to have been so much heated as to have approached a state of fusion. On examining the interior, there was found a deposition of salt and other solid matter, which had accumulated to upwards of two inches in thickness. I have now in my possession a piece of the sediment two inches through. This deposition was effected in less than 20 days, and only, as I was informed, because the *engineer was not aware of the probability of such an occurrence*, nor of the importance of frequently *blowing out* the boiler, when salt water is used. The statement of this fact induces me to repeat a

hint contained in the following extract from a communication in the Boston Evening Gazette, 5th June, 1825.

"We close with a suggestion, which, if adopted, may add one more to the safeguards recommended by others. Fully persuaded, that much of the evil there is so great reason to lament, has arisen from confidence in unqualified persons, we think it would be a good plan to establish a board of examination in all places where steam engines are much used, and to pass a law prohibiting, under severe penalties, the engaging of any person as an engineer who was not furnished by the board where he sought employment, with a certificate of his being *morally and intellectually* qualified for the duty.

"If the awful consequences had not rendered the subject too solemn, we should certainly feel disposed to indulge in a little levity at the expense of that class of men so ridiculously and preposterously dubbed engineers. This is, in our estimation, a designation implying ability, study, and practical skill. Whether these qualities are usually possessed, let those decide who have had an opportunity of judging. Has it not frequently happened that men have been taken from the work bench, and, if they had barely understanding enough to oil a gudgeon, drive a wedge, or screw up a nut, have been thought adequate to a most responsible duty, on a faithful and intelligent discharge of which, depended the happiness of thousands?

"The plan proposed, or something similar, would, in our opinion, furnish a remedy for this part of the evil."

The preceding may contain nothing new, or, if new, nothing useful; if so, it will only add one to the number of idle things already written on this subject, and I must apologize for the trouble and loss of time its perusal has occasioned. In stating the fact respecting the destruction of a boiler, by the deposite of saline and other matter, I have merely intended to add one to numerous others, which lead to the belief that accidents probably arise more from carelessness and ignorance, than from any *mysterious* operations of steam. Since writing it, other similar cases have come to my knowledge, all relating to boats employed in this harbour. In these instances, which are three in number, the boilers were destroyed in a very short time by concretions on the interior. On examining one boiler, a sediment six inches thick was found. The engineer, who had the care of it, was warned of the danger, and the necessity of guarding against it, but "knew better." Another instance of injury arising from inattention, or want of knowledge, happened last summer in a boat on Connecticut river. While in operation, its movements became gradually slower, until it entirely ceased. The constructor being on board, descended to the fire room, to ascertain the cause; he turned the gauge cocks, but no water issued, and on looking into the furnace, he discovered that the whole bottom of the boiler was at nearly a white heat. Knowing what ought to be done on such an emergency, he immediately extinguished the fire, and waited until the boiler had cooled down, before he permitted water to be injected; but his *engineer*, as he acknowledged, would have

poured water into it, had there not been some obstruction in the pipes, and would no doubt have blown both boat and passengers out of existence.

Here are accidents, harmless indeed, excepting in the loss of time and money, in which the cause of injury is obvious; and, generally speaking, the cause lies no deeper than in the instances cited, wherever it has been accurately traced. A correct and satisfactory narrative of facts connected with those awfully destructive explosions which have so strongly excited the public sympathy, can rarely be obtained, nor indeed can it be reasonably expected. They who *could* give correct information, are usually placed beyond the reach of inquiry; and they who survive, and *should* know, are too much interested in palliating their own misconduct, to furnish candid representations. Our judgment, then, must be directed by those occurrences whose origin cannot be concealed, whatever motive may exist for secrecy or deception. Adopting these as our guides, the main sources of danger are readily discovered; but are not these too much neglected? Is there not, in seeking for the causes of explosions, too great a disposition to refinement? Is not scientific vanity taking the place of an unostentatious pursuit of simple truth? There appears to be an ambition to discover a supposed mysterious property or condition of steam, whose development is to be the basis of distinction and extended fame. In this spirit, a vacuum has been imagined *under* the water, and safety air valves to the *bottoms* of boilers, have been soberly recommended. Let practical science and skill be first devoted to the devising of remedies for known evils, and the imagination may afterwards flutter about at leisure in the regions of speculative theory. When the visible difficulties which encumber the surface are cleared away, there will be much less perplexity and uncertainty, in discovering and removing those which are more deeply seated.

It appears very plainly that the safety valve, as usually constructed, rarely preserves the attributes which its name imports. Instead of being so designated, it should be christened anew, and called the *Betrayer.* Not a boiler has been burst, not a boat disabled, not a limb mangled, nor a life destroyed by steam, that has not been placed under the protection of this false guardian. All its promises of security are treacherous, and the confidence which has been placed in it has been rewarded by excruciating suffering, or death. The experiments of Clement, prove that it cannot be relied upon; in vain is it urged by the raging steam, to perform the duties to which it is pledged, and to open a free passage for the escape of the destroyer. Having taken its stand, it resists all pressure, and maintains its position with a pertinacity proportioned to the force applied to drive it off. I have devised some plans which I fondly hope will be found effectual to correct this perversity of disposition, and give a more *amiable* trait of character, if possible, to this interesting appendage to the steam engine. To effect this object, it is necessary that a regular supply of water should be insured in the boiler, and this also I hope to attain. I am aware, however, that it is much more easy

to draw plans upon paper which shall have a very promising appearance, than it is to construct instruments which shall perform the duties which we may assign to them. I have, therefore, determined to adopt the wise plan of a fair practical experiment, before presenting you with diagrams of my apparatus; and should I succeed, according to my intentions and anticipations, you shall again hear from me.

R. D. H.

Boston, March 21, 1831.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Splicing a Water Wheel Shaft.

Respected Friend,—Deeming it the duty of every one to disseminate that knowledge which experience or observation may supply, and which appears calculated to conduce to the prosperity of the arts and manufactures of our country, we send the following notice of an expedient to which we have resorted, in repairing the shaft of a water wheel, leaving thee at liberty to make such use of it as may appear best.

Having occasion to renew one of our water wheel shafts, last summer, and desirous of avoiding the great difficulty and expense attending the procuring and fixing a piece of timber of sufficient length, the idea of splicing it occurred to us, as, upon examination, the water end appeared to be perfectly sound. We procured a short piece of timber, and coupled it to the sound part by means of a gudgeon and sleeve, and have found it to answer the purpose well, with a very trifling increase of the friction. The advantage of this plan is, that of procuring a short shaft instead of a long one; which may be again replaced, as the wet end will last for a very long period, whilst the other will not be so subject to the dry rot.

With respect,

J. & S. P. Gilpin.

Triadelphia, Montgomery county, Maryland, April 2, 1831.

Remarks on some erroneous statements made by Mr. J. Shaw, in his "Observations on a Patent obtained by Lieutenant Bell, for a Percussion Lock."

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

In the Journal for February last, there is an article, communicated by Joshua Shaw, relating to percussion locks for cannon, which contains imputations of a highly dishonourable character upon the conduct of Lieutenant W. H. Bell, of the United States army. The facts alleged in that article, are, in substance, that Lieut. Bell, by insidious means, obtained the particulars of an original and important invention from Mr. Shaw, the inventor; and, that he afterwards

endeavoured to appropriate the credit of this invention to himself, by obtaining a patent for it, as an original discovery of his own.

These are serious charges, and the article states that they can be sustained by the "most unimpeachable evidence." If they could be thus sustained before a competent tribunal, it would cost Lieut. Bell his commission, and consign his character to irretrievable disgrace and infamy.

Lieut. Bell is well known to many of the distinguished officers of the army and navy. He belongs to a profession which tolerates no dishonourable conduct in any of its members; and those who know him, believe him to be utterly incapable of the baseness with which he is charged before the public, in the Journal. He is now absent, at a remote station, where he may not, for a long time, meet with these foul aspersions on his character. It is, therefore, the duty of a friend, to whom all the material facts of the case are known, to lay a brief statement of them before the readers of the Journal.

Lieut. Bell applied to Mr. Shaw, as a manufacturer of percussion primers, to procure a number of these articles made according to a particular pattern, but which he did not obtain. This occasion was certainly the *first*, and, it is believed, the *only one*, on which Lieut. Bell ever saw Mr. Shaw. The interview occurred on the 18th day of April, 1829. This date is stated on the written authority of Mr. Shaw himself, recorded on that day.

The instrument for which Lieut. Bell has obtained a patent, was made and applied in the manner described in his specification, on, or before, the 13th of October, 1828, more than seven months prior to the interview with Mr. Shaw. The merits of the instrument were successfully demonstrated on that day; and the trial of it was continued on subsequent days, for several weeks, and until it had fired a cannon one thousand times, when the instrument remained in good order for further service. These facts are recorded in official documents, which were received and placed among the public records of the war department, in November, 1828. And the same facts were made known to Mr. Shaw, at the interview which he has undertaken to describe; the very time at which, as he now asserts, he imparted to Lieut. Bell the information which enabled him to construct the instrument; but which, as is now proved, had been made and tried a thousand times, more than half a year before. It is left with Mr. Shaw to reconcile these dates and facts, with the assertions and insinuations which are contained in the article to which his name is affixed in the Journal.

It is also alleged in the article referred to, that the instrument for which Lieut. Bell has obtained a patent, "is not in any essential particular, different from one patented on the 24th of October, 1828," by Mr. Shaw. Few persons would be able to discover the points of resemblance between them, or to point out the parts which are common to both, either in form or arrangement. But without undertaking to describe either, it is proper to point out *one* particular in which they differ; and which any other person than the author of the article quoted, would be apt to regard as *material* at least, if

not essential. It is this: when the instruments are applied to fulfil the purposes for which both are alike designed, the one never fails, the other never succeeds.

Three of Lieut. Bell's locks, have been applied to different kinds of cannon, embracing the largest and the smallest used in the military service. They have fired these cannon about two thousand times, and many hundred times in succession, without a single failure, leaving all the locks in perfect order for continued service. These facts are recorded in official documents.

Of Mr. Shaw's locks some hundreds have been made for the public service. To what extent they may have been tried, may not be accurately known to the writer. But in all the trials which have been made, and officially recorded, it does not appear that any one of them ever made more than *four* fires, without being destroyed. The repeated failures of these locks, have, as is well known to the patentee, destroyed all confidence in them on the part of the experienced officers of the public service. It would be difficult to find any one who has witnessed the trials, who would permit one of them to be put on a gun, with which he was about to face an enemy. And it may be inferred that the patentee has himself abandoned them, as he has, very recently, presented a very different contrivance for effecting the same purpose.

It would appear that Mr. Shaw claims the merit of discovering the *principles* of the application of the percussion locks and primers, to the firing of cannon. It is a matter of official record, that this principle was communicated to him by another, more than eight years ago.

The writer is aware, that topics of this nature can possess very little interest in the estimation of the readers of the Journal. But as its pages have been made the medium of a wanton assault upon the character of an honourable man who is absent, it is but an act of justice to an injured individual, that these remarks should appear in the same journal, and it is on this ground that their insertion is solicited.

As the writer has no ambition to parade his name before the public, in matters of this sort, he does not annex it. It is, however, at the service of any one who may feel aggrieved by what he has stated. JUSTICE.

Washington, April 26, 1831.

FRANKLIN INSTITUTE.

Quarterly Meeting.

THE twenty-ninth Quarterly Meeting of the Institute was held at their Hall, on Thursday, April 21st, 1831.

THOMAS FLETCHER, Vice President, presided, and

Mr. ALEXANDER FERGUSON was appointed Rec. Sec'ry, *pro tem.*

The minutes of the last quarterly meeting were read and approved.

The quarterly report of the Board of Managers was read and accepted, when, on motion, it was referred to the committee on publications, with instructions to publish such parts as they may deem expedient.

The quarterly report of the Treasurer was read and accepted.

(Extract from minutes.)

THOS. FLETCHER, *Vice President.*

ALEXR. FERGUSON, *Recording Secretary, pro tem.*

Twenty-ninth Quarterly Report of the Board of Managers of the Franklin Institute, to the Institute.

THE Board of Managers entrusted with the administration of the affairs of the Franklin Institute, for the year 1831, in compliance with the salutary custom established by their predecessors, present the following report of their proceedings in the first quarter of their term of service. The cardinal interests of the society have been, as usual, placed in the charge of standing committees, and those objects which were deemed sufficiently important to merit the attention of the Institute, have been continued under the care of the select committees appointed by the former Board. The courses of instruction in Chemistry, Natural Philosophy, Mechanics, and Drawing, for the session of 1830 and 31, have been completed, and the Board have great satisfaction in announcing, that this department continues to receive from the members a cordial and gratifying support. The attendance of a class of 60 pupils upon the instructions of the teachers of drawing, and the orderly and correct deportment of the students, confirm the Board in their high opinion of the merits of the instructers in this important branch of education for practical mechanics, and warrant them in the indulgence of pleasing anticipations of the increased skill and ability which the rising generation of workmen will display in the production of those objects, which contribute to the wealth, the independence, and the comfort of the community. The regular lectures on chemistry, and natural philosophy, and mechanics, have been attended by numerous and highly respectable classes of both sexes, and the deep attention with which the demonstrations of the professors have been received, furnishes conclusive testimony in favour of the continuance and extension of this department. For this purpose, the committee of instruction now has under consideration, the expediency of establishing a professorship of practical mechanics, and we would especially call upon the members of the Institute not to suffer a proposition, fraught with such manifest advantage, to be postponed or abandoned for the want of pecuniary means to carry it into operation.

We are indebted to Mr. A. Miller, J. R. Leib, Esq. and Mr. A. Crease, for many valuable volunteer lectures, bearing upon the interests of useful knowledge and scientific acquirements, for which the warm acknowledgments of the Board of Managers have been presented to those gentlemen. The high character which the practical men of Philadelphia have for skill in their professions and

general intelligence, should operate to bring them before the public in the character of lecturers; and the importance of correct views to the young mechanic, will, we trust, call into the field, in the session of 1831–32, a numerous corps of practical volunteers, who, despising the profit of retaining in secret the experience which they possess, will render it of double value by sharing it with the public.

The Board, deeply impressed with the benefits which have hitherto attended the exhibition of American manufactures, held under the auspices of the Institute, directed the early attention of the committee on premiums and exhibitions to that subject, and in conformity with their favourable report of the expediency of holding one in the fall of the present year, have caused an address to the manufacturers of the United States, with a list of premiums, to be published, and the committee are now actively engaged in the necessary preliminary operations which are requisite to a successful completion of the wishes of the Board. It is hoped that a very early appointment of the committee of arrangement, and the exertions of competent agents in the large manufacturing districts of the Union, will insure, at the next exhibition to be held by the Institute, an unrivalled display of our domestic products, and confirm the Board in the opinion, that honorary rewards offer a powerful stimulus to bring into operation the skill and ingenuity of our fellow-citizens. For this exhibition, the Board respectfully claim the cordial co-operation of the members of the Institute, in contributing to its embellishment, as well as in disseminating its plan in the extended circle of their acquaintance. The library and reading room continue in beneficial operation, and are regularly attended by a numerous portion of the members of the Institute. The importance of these departments demand considerable enlargement, but the limited pecuniary means at the disposal of the Board, prevents as large an appropriation to the committee on the library to improve and extend their usefulness, as is desired. Our main reliance for the gradual extension of these important auxiliaries, is in the known liberality of our fellow-citizens, from whom, donations to these objects are frequently placed at the disposal of the Board. The committee on minerals are now actively engaged in classifying and arranging, in a scientific manner, the collection of minerals now in our cabinet. They are aided in their labours by Mr. Jacob Pierce, whose valuable assistance in rendering this department useful, merits the highest eulogium. The Board have to regret that the professional engagements of their committee on models, have hitherto prevented their attention to the classification and arrangement of the models, now belonging to the Institute. We have reason to believe that the exertions of the members directed to the increase of the cabinet of models, would result in an enlarged and valuable collection of objects, teeming with instruction to our mechanics, and tending to prevent, in a great degree, the lavish expenditures of money, time, and industry, in the formation of machines which have already been successfully put in operation by the ingenious men of our country.

The committee charged with investigating the value of water as

a moving power, have brought the experiments connected with the main question to a conclusion, and a part of their valuable report will appear in the March number of the Journal, which is now on the eve of publication. A course of experiments on adjutages has been commenced under the auspices of the same committee, and is now almost completed—the public will be put in possession of the result as soon as practicable. To the gentlemen composing this committee, the thanks of the community are justly due; and the Board appeal with confidence to the members of the Institute and the public, to relieve the committee from the pecuniary responsibility under which they rest, for the payment of the excess of their expenditures above the amount received in subscriptions. The experiments on the causes of explosion in the boilers of steam engines, and the means which may tend to prevent so frequent an occurrence of these evils, are now progressing, and much valuable information has been placed in the hands of the committee. The apparatus intended for direct proof of the theories upon these subjects, is in a state of forwardness which will insure the publication of the results from actual trial, immediately after the report of the committee on water power has been printed. The Board have to announce the loss of the valuable services of Messrs. Thomas Loud and John Wiegand, as managers of the Institute; the vacancies have been filled by the election of Messrs. George Fox and George W. Tryon. In concluding this report, the Board cannot refrain from expressing the high gratification which they feel in the present flourishing condition of the Institute, and the only regret which mingles with this feeling, is caused by the limited participation of the mechanics and manufacturers of our city, in an institution which offers to their acceptance the riches of science in all its varied departments, at a yearly cost far below the weekly expenditures of many on mere sensual gratifications. We call upon them by that consideration which usually brings into action all the best energies of man, his own interest, to come forward and enrol themselves as members of the Franklin Institute, and as ardent, efficient, and free fellow labourers in the field which is cultivated by this institution, to exhibit to the world that our complete independence is caused as much by the beneficial communication of mutual knowledge, as by the freedom of our civil constitutions.

SAML. J. ROBBINS, *Chairman, P. T.*

WM. HAMILTON, *Actuary.*

Monthly Meeting.

THE stated monthly meeting of the Institute was held at their Hall, on Thursday evening, April 27th, 1831.

Mr. C. C. HAVEN, was appointed chairman, P. T.

The minutes of the last meeting were read and approved.

The following donations were presented to the Institute, viz.

By Chs. Babbage, Esq., of London.

Reflections on the Decline of Science in England, and on some of its causes.

An Address to the Labourers, on the subject of Destroying Machinery.

By John Gilmore, Esq.

Congressional Directory for the Second Session.

By the Newark Mechanics' Association.

An Address delivered before the Association, by Professor John Griscom.

By Jas. J. Barclay, Esq.

First and Second Annual Reports of the Inspectors of the Eastern Penitentiary of Pennsylvania.

Remarks on the Expediency of Abolishing the Punishment of Death.

By Jas. R. Leib, Esq.

A Lecture on Scientific Education, delivered before the Institute.

By Geo. W. Smith, Esq.

Arguments in favour of the proposed Canal round the Western Abutment of the Schuylkill Permanent Bridge.

By R. C. Winship.

Ouvres Diverses, 1685.

Fourteen Numbers Casket.

Twenty do. Ariel.

Fifty do. Souvenir.

By Messrs. Carey & Lea.

Reports on Locomotive and Fixed Engines; with an account of the Liverpool and Manchester Railway.

By Mr. James Ronaldson.

Seybert's Statistical Annals of the United States.

Memoirs of the Life and Writings of B. Franklin, 6 *vols.*

An Account of the Louisville City School, with the Ordinances of the City Councils, and the Regulations of the Board of Trustees for the Government of the Institution.

Thirteenth Annual Report of the Controllers of the Public Schools for the First School District of the State of Pennsylvania, with their Accounts.

By Professor A. D. Bache.

Sur les Machines á vapeur et sur les Explosions des Machines, á vapeur, par M. Arago.

By Professor Franklin Bache.

Report of Moncure Robinson, Esq. and Col. S. H. Long, Engineers, appointed by the Canal Commissioners for examining the different Routes for Crossing the Alleghany Mountains; Read in Senate, 14*th March*, 1831.

An Introductory Lecture on Political Economy, delivered at Nassau Hall, Jan. 31, 1831, *by Professor Vethake.*

Third Report of the Oneida Institute of Science and Industry.

By Provost Wm. H. De Lancey, D. D.

A Charge addressed to the Graduates in Medicine, of the Uni-

versity of Pennsylvania, by himself, at the Public Commencement, held March 24, 1831.

By Professor W. R. Johnson.

A Lecture on the Importance of Linear Drawing, and on the Method of Teaching the Art.

Some Observations on the Electrical Characters of Caoutchouc.

By Col. S. H. Long.

Report to the Canal Commissioners in Reply to Strictures, passed by Mr. Robinson, on the Views entertained by Lieut. Col. Long in relation to the Manner of Crossing the Alleghany Mountains by means of a Rail-Road.

The corresponding secretary laid on the table the following works, received in exchange for the Journal of the Institute.

London Journal of Arts and Sciences, for January, February, and March.

The Mechanics' Magazine, for December, January, and February.

The Repertory of Patent Inventions, for January, February and March.

The Register of Arts and Journal of Patent Inventions, for January, February and March.

The Journal of the Royal Institution of Great Britain, for February.

Recueil Industriel, for June and September.

Bibliothéque Physico-economique, for November and December.

Annales de Chimie et de Physique, for August and September.

Journal Universel des Sciences Médicales, No. 175.

Journal Universel et Hebdomedaire de Medecine et de'Chirurgie, Vol. 1. *No.* 1 *to* 12.

Bulletin de la Societé d'Encouragement pour l'Industrie Nationale, for September.

Annales de l'Industrie Francaise et estranger, for June, July and August.

North American Review, for April.

American Annals of Education, for March and April.

Journal of the Philadelphia College of Pharmacy, for April.

Magazine of Useful and Entertaining Knowledge, for February.

The American Quarterly Review, for March.

The Ladies' Book, for March and April.

The American Journal of Arts and Sciences, for January.

The subject appointed as the topic of discussion for this evening being called up, some remarks were made; after which it was continued as the subject for the next meeting, and the following was also appointed for the same evening, viz.

What are the best means of securing the boilers, cylinders, and all other parts of steam engines, whether employed for stationary purposes, for navigation, or for locomotive carriages, against loss of heat by radiation and conduction?

C. C. Haven, *Chairman.*

J. H. Bulkley, *Recording Secretary.*

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN JANUARY, 1831.

With Remarks and Exemplifications, by the Editor.

1. For a mode of *Saving Water in Water Power;* Aaron Foot, Williamstown, Berkshire county, Massachusetts, January 4.

The patentee tells us that he claims the "applying to useful purposes, that momentum which water retains after passing from the principal, or common water wheel."

This it is proposed to do by applying a second water wheel, to be operated on by this *waste* water. The two wheels are to be geared together, by the intervention of cog wheels. The secondary wheel is to run more slowly than the principal, in the supposed proportion of the power of the two.

We recollect a similar project having been patented two or three years ago; and some of the water wheels which are in use, certainly appear as though they might be aided by such an appendage; we, however, are decidedly of opinion that in all well constructed wheels, it would be a waste of power to attempt to gain any from the waste water; and no one will commend the plan of constructing a main wheel badly, for the sake of applying a secondary.

If there is more *momentum* in the water, after it leaves the wheel, than is necessary to carry itself off, the structure is bad; and if there is not, the secondary wheel may do much harm, but cannot be productive of any good.

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2. For a *Vertical Tooth Extractor;* Ira W. Rutherford, Albany, Albany county, New York, January 4.

Numerous vertical extractors have been made, and every dentist of any eminence has tried them. There are cases in which they may be used with advantage, but so far as our information goes, those who have possessed the best instruments of the kind, have rarely employed them. In by far the greatest number of instances, a well constructed key, skilfully used, is the best. The extractor now proposed is ingeniously contrived, but although it differs in the construction of some of its parts from others made with the same intention, its general operation is the same. The tooth is to be embraced between claws, which are wedged together by forcing a piece between their upper ends by means of a thumb screw, on the main shaft of the instrument. A piece of India rubber, of soft wood, or of some other suitable substance, rests upon a sound tooth, or teeth, to operate as a fulcrum.

The patentee says, that "the advantages which it has over a newly mounted instrument, is, that it combines the lateral motion with the perpendicular." We do not know to what newly mounted instrument he alludes, but, whatever the individual may be, there are more than a dozen others variously constructed, and the question,

of superiority, therefore, does not lie between it and one other instrument only, but between it and a number of competitors.

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3. For an improvement in the *mode of adjusting metallic plates to artificial teeth;* Thos. R. Vanderslice, city of Philadelphia, January 5.

Instead of applying a metallic plate on the back part of the artificial tooth, in the usual manner, the tooth is to be moulded with a groove in the back part of it, into which the metallic plate will fit, and where it is to be secured by riveting or soldering to platina wires laid in their proper places in the groove at the time of forming the tooth.

There is to be a strip of bone, ivory, or other hard substance used to form the groove in moulding the tooth, and this is to be drilled to receive the wires. Neither this, or the manner of forming the groove, is represented by drawings, which certainly might have been done. We have repeatedly quoted the words of the patent law relating to this point, "and *shall* accompany the whole with drawings and written references, whenever the nature of the case *admits* of drawings."

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4. For a *Furnace for generating Steam for Culinary Purposes;* Jesse Reed, Marshfield, Plymouth county, Massachusetts, January 5.

This furnace may be made of cast iron. It is to consist of two vertical, cylindrical vessels, one placed within the other, a space being left between their sides to contain water. The inner vessel is to form the fire place, the bottom of it is formed of bars, and upon them the fuel is to be placed, and is consequently surrounded by the double cylinders which contain the water. A close cover forms a steam tight connexion between these cylinders, and has in it perforations for steam pipes to lead into other vessels, and for a safety valve. Above the fire, there is a grate to sustain a kettle, or other vessel, in the manner of the common clay furnaces.

"The improvement in my said steamer, which I claim as new, consists of such additions of surrounding parts to the common clay or soap stone furnace now in use, as will enable me to arrest the portion of heat which in ordinary use, escapes through the side of the furnace, and with it to boil the water which generates the steam for the purpose before mentioned."

All this may be very intelligible to some folks, but such is not the case with us. We are at a loss to discover in what way the heat which escapes through a clay, or soap stone, furnace, is to be saved, where neither of the materials are employed; and furthermore, we apprehend, putting both clay and soap stone out of the question, that this contrivance will not be found either very convenient or useful.

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5. For an improvement in *Thrashing Machines* for thrashing all kinds of chaff grain; Isaac Norton, Saratoga, Saratoga county, New York, January 6.

The beaters are to be placed upon four arms instead of upon a cylinder. The feeding apron is to be of slats of wood, the teeth are to be square and tapering, and from three-fourths to two inches long. There is to be a hollow segment supported by springs, and means are to be adopted for giving motion to the moving parts. There is no claim to novelty; the beaters, the wooden apron, the teeth, the segment, &c. being all very old, we, therefore, greet and dismiss them with all the veneration which their antiquity inspires.

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6. For an improvement in the *manufacturing of Ropes;* Edward S. Townsend and Philo Durfee, Palmyra, Wayne county, New York, January 6.

(See specification.)

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7. For a *Machine for taking out stumps from land;* Abijah Gorham, Turner, Oxford county, Maine, January 7.

A wheel and axle is mounted so as to be drawn about upon truck wheels. From the middle of the axle a chain descends, which is to be fastened to the stump. Oxen are to draw upon another chain passing round the wheel, and thus the stumps are to be raised. We are not informed whether this machine is claimed wholly, or in part only; this would indicate that the patentee considers it as altogether new; but, according to information *derived from other* sources, we arrive at a very different conclusion.

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8. For *Blocks, on which Stereotype Plates can be imposed,* denominated "Stereotype Extendible Blocks;" George W. Grater, city of New York, January 7. (Assigned to Elihu White, New York.)

Instead of the separate blocks usually employed, strips of mahohogany, reduced to a proper width and thickness, are to be locked up in a common printer's chase. The same strips, under a different arrangement, serve for folio, quarto, octavo, 12mo. or 18mo. pages. Six of the strips are to be about three inches wide, and six to be about three-quarters of an inch. Upon these latter are the proper hooks, or clasps, for retaining the plates. The particular construction of these strips and clasps are shown in drawings which accompany the specification. The wider, are called major, and the narrower, minor blocks. The claims are, to the particular plan of fashioning and arranging the blocks, so as to produce the effect intended. The using of fixed hooks attached to blocks, for the purpose explained in the specification: and the combination of the whole, in the manner set forth.

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9. For a Machine for *smoothing the bodies of Printing Type.* Invented by Stephen Sturdevant, of the city of New York; assigned to Elihu White, of the same city, and patent issued to him, January 7.

"In place of the usual mode of smoothing the type by rubbing

them under the fingers, on the flat surface of a grit-stone, I produce the same effect on them, by causing them to pass between two rotary blocks of metal, faced with steel, and having floats cut in the steel faces, to scrape the type as they pass through."

The specification refers throughout to drawings which represent the machinery in a very distinct manner, and occupy considerable space. Without a view of the machinery, the claims could not be understood; they, however, are very clearly made out.

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10. For a *Machine for casting Type,* invented by Michael D. Mann and Stephen Sturdevant, both of the city of New York; assigned to Elihu White, of the same city, and patent issued to him, January 7.

The remarks on the last patent apply with full force to the present. Judging from the drawings and description, the machine appears to have been devised with much skill; and every part of it is represented with great neatness and precision.

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11. For an improvement in *Frames for Cotton Gins;* Ebenezer A. Lester, Boston, Massachusetts, January 8.

This patent is taken for making the frames of cotton gins, in whole or in part, of cast iron. The claim is to the "making of the two ends of the frame of cast iron, whether the said ends be connected together by girders and sills of wood or metal."

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12. For an improvement in the *construction of Boats,* whether propelled by steam or other power; Nathan Cushman and Isaac Loomis, Whitehall, Washington county, New York, January 8.

A channel is to be made in the boat from stem to stern, to allow a free passage to the water; and in this channel the paddle wheel is to work. There is to be an inclined plane running from the bow of the boat, back to the wheel, and crossing the channel in which the wheel runs. This is to form a flume, up which the water is to rise, and from which it is to act upon the wheel. Such appears to be the intention, so far as we can understand the description. But as reference is made, throughout, to a model, and this part is not represented in the drawing, we are left to guess upon this point. It is altogether irregular to make any such reference, to a model; and to depend upon it, as in the present instance, would be likely to avoid the patent, as of this a model makes no part. The drawing is imperfect and inadequate, not exhibiting the parts described, or having any written references. There is no claim; and it is manifest that the patentee does not depend upon the inclined plane, as he tells us that the boat may be used either with or without it; all that is then left, to rest the patent upon, is the channel along the middle of the boat, which is a well known contrivance, having been long, and repeatedly used.

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13. For an improved *Portable Grist Mill;* Henry Weed, Sandwich, Stafford county, New Hampshire, January 10.

The stones are proposed to be much larger than in most of the portable mills recently patented; say thirty inches in diameter. A frame is to be made to support the stones, at the lower part of which frame there is to be a bridge tree, which is to be raised by a screw. The lower mill-stone is to be fastened on a spindle, and the upper is to be fixed upon the frame, with ears, screws, and nuts, to adjust it. Through the top stone there is an eye, as usual, for the feed. An iron bar crosses this stone over the middle of the eye, and receives the upper end of the spindle. The bar has springs to it to allow it a little play.

The claim is to the above arrangement, with the nether mill-stone running instead of the upper; the mode of adjusting the upper stone; the supplying the weight of stone by the bridge tree, and the bar and spring to sustain the upper end of the spindle.

Without inquiring into the originality of the other parts, we may observe that the running of the lower mill-stone has been more than once patented, and that the claim to this, therefore, must fail entirely.

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14. For an *improvement in Distilling;* John Cairou, city of New York, January 10.

This apparatus is intended to produce highly rectified spirit at one operation. The vapour, as it rises from the still, passes through successive receivers, like kettles placed upon each other. The portion which is condensed in each dropping through a tube back into the vessel below it. After escaping from these, the vapour passes through a horizontal worm; each coil of this worm has a tube leading down from its lower part, into a common tube, to conduct that portion of the spirit off, which is less highly rectified than that which passes through the worm; this latter is finally condensed in the usual way. The parts intended to be claimed appear to be those which allow of the escape of the less pure spirit in its progress towards the final condensing tub.

This patent refers, throughout, to a model; a fault into which patentees, for want of better information, are very apt to fall. We have noticed this in No. 12.

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15. For a Machine for *edging and drawing Steel Points for Carriage Springs;* George Stoudinger, Newark, Essex county, New Jersey, January 11.

A female die is to be formed, consisting of a steel roller, running as a flatting mill roller, and hollowed out in such a way as to suit the point to be drawn. Below this roller is a bed, which advances upon a carriage, as the roller turns. The platform of this bed has an inclination given to it, which is regulated by means of screws, in order to adjust it to the degree of taper to be given to the point. There is no claim; but as we believe the mode of drawing the points by means of the inclined plane, to be new, the machine itself may, in that case, be considered as altogether so, this being its essential

feature. The plan proposed appears to be not only more easy of execution, but much preferable in practice to the use of eccentric rollers.

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16. For a *Thrashing Machine;* Samuel Turner, Aurelius, Cayuga county, New York, January 11.

This machine has a cylinder, and bed, with teeth, in the usual way. The teeth are to be of wrought iron, and are to stand out about two inches. They are to be tapering, being about three-quarters of an inch wide at bottom, and one-quarter at top, placed in such a manner as to escape those in the bed, and leave proper space between them as they pass. The claim is to the formation and structure of the spikes, or teeth; their position in the bed and cylinder, and the lining of the bed with band irons.

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17. For a Machine for *Thrashing Grain, and Dressing Flax and Hemp;* Stephen J. Gold, Cornwall, Litchfield county, Connecticut, January 11.

In this machine there are several pairs of beaters, or tumblers, between which the grain, or hemp, is to pass successively. Whirls of different sizes are used to drive them, and they are thus caused to move with different velocities. The claim is to "several pairs of beaters or tumblers in the machine, one pair moving faster than another; and the combination, viz. the grain, hemp, and flax machine."

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18. For an improvement in the common *Tin Baker;* Gordin Williston, New London county, Connecticut, January 11.

This baker is to stand before the fire, and is in fact what is commonly called a tin kitchen. The lower part is to be made to reflect heat upwards, as the upper part does downwards.

"What I claim as new, and as my invention, and nothing else, is simply the substitution of the reflecting surface in the lower part of the pan, instead of the box for coal as in the baker in common use. Making thus the 'Double Reflecting Baker.'"

We do not understand the description given, and cannot, therefore, point out the merits of this invention.

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19. For an improvement in the *Mode of Curing Tobacco;* Tyre G. Newbold, Franklin county, Virginia, January 11.

The improvement proposed is, "after having a tight house in which the new cut tobacco is to be hung, build a furnace at a convenient distance from the walls of said house, and have a funnel extending on the ground from said furnace through the house, and turning back discharge the flame and smoke in the open air, at a convenient distance from the building. The furnace and funnel to be made of brick, stone, or other incombustible material." This comprises the main point of the specification, and we much mistake if the

claim of the patentee, to be the true and original inventor or discoverer, will prove to be an undisputed one.

There is no drawing of the furnace and funnel; objects which certainly might be drawn, and a representation of which would undoubtedly aid those who wish to carry the plan into operation.

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20. For an improved mode of making *Harrows for the purpose of Agriculture*, called the "Revolving Harrow;" Samuel Rugg, Lancaster, Worcester county, Massachusetts, January 11. (See specification.)

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21. For the *Application of Water to Mill Wheels;* which the inventor calls "the Syphon Principle, or Artificial Pressure;" William Kendall, Fairfield, Somerset county, Maine, January 12.

The specification of this patent is drawn up with great labour; it includes many numerical calculations, and an essay upon the application of water in mills of different kinds. From the course pursued it would be extremely difficult to give an analysis or epitome of this paper; we will, however, make one or two quotations, which may perhaps afford a general idea of the proposed plan. The wheel is a kind of tub wheel, with the buckets secured between two rims, with the shaft connected to one of them.

"The wheels which I have constructed and applied to my invention, have buckets, as it were, at right angles with the former wheels, and lie thus \\\\\\\\. The water may seem to act upon it by pressure from the whole of the head, but it is only by reaction that the wheel moves. This wheel which I have constructed for ease in making, and permanency of its parts, may represent at a glancing view, that which was formerly called a tub wheel, except it has no arms, the buckets entering the shaft, and are supported in the rim; they are very flat, and very thin; their edges which cut and leave the water are made sharp. By their obliquity they scarp or lap over each other, and the space between them all is called the throat, or opening of the wheel; they decline about three or four inches to a foot of their width. For a wheel of four feet diameter, with seven buckets, their width becomes about fifteen inches at the shaft, and two feet at the rim. This rim then requires to be about ten and a half inches deep, so as to extend one inch below the buckets, and two inches above, for passing a feather edged bar of iron through with its thick edge resting against, and fair with, the buckets, as a cutter; one end being driven well into the shaft, the other end bent down and supported under a hoop, which binds the rim and wheel," &c.

The specification, of which we have copied a very minute part, thus concludes: "Thus have I endeavoured to explain the principles and how to use this invention, where an additional artificial pressure is applied to the wheel, increasing its effects by suction, which I call the syphon principle, where the force of the percussion of water, as well as gravity, is applied to repel the atmospheric pressure, which I claim as my invention when applied to mill wheels. Also the

wheel and parts for applying the same according to this my specification."

We confess that we do not understand the reference to the atmospheric pressure, and the syphon principle, although we have carefully read the parts in which they are described; but the description is an involved one, and we could not take the time to make it a study, without a fair prospect of learning something from it. The drawing which accompanies the specification, lends little or no aid to the description, being very indifferently executed.

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22. For an improvement in the *Manufacture of Buttons*, called the Safe Eye Button; Charles Goodyear, Philadelphia, Pennsylvania, January 12.

This patent is taken for enclosing pieces of cloth, leather, or other substances which can be penetrated by a needle, between plates of metal. These plates have a hole of one-quarter of an inch diameter punched in them, to serve as an eye through which the sewing is to be effected.

"The improvement which the said Charles Goodyear claims consists in the manner of fastening between the shells, the cloth, leather, catgut, or substance to be sewn through, and in making the eye of the button of cloth, leather, catgut, or other substance of a similar form, leaving holes, and thereby obviating the objection to most buttons which are liable to cut the thread with which they are fastened on clothes."

The specification describes the formation of the plates or shells, and the manner of uniting them; but these are not represented by drawings, which ought to have been done.

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23. For an *Instrument for the Teaching of Geography;* Elizabeth Oram, city of New York, January 12.

As this instrument is the invention of a lady, we will, of course, allow her to tell her story in her own way, without any animadversions of ours, which might mar the narrative, or involve us in inextricable difficulties.

"Be it known, that I, Elizabeth Oram, of the city of New York, have invented a new and useful instrument for the teaching of geography, and that the following is a full and exact description of the construction and use thereof as invented by me.

"It consists of a globe, upon which the surface of the earth is represented by various heights, as they exist in nature. By this the distinction between land and water is clearly seen. The various ranges of mountains, with their relative heights exhibited; and their influence upon heat and productions, with their geological structure.

"By means of a magnet inserted in the surface of the improved globe, the great principle of attraction may be clearly shown, by affixing thereto any small iron figure.

"This globe is surrounded by the principal circles of the sphere, The ecliptic is elevated, by means of which, and a moveable and

illuminated sun, the manner in which the earth receives its rays, and the causes of seasons, may be clearly exhibited. On the horizon there is affixed a small instrument, by which the causes of eclipses are shown.

"A moveable star, brings to the comprehension of pupils the nature of right ascension, declination, celestial latitude and longitude."

Elizabeth Oram.

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24. For an improvement on the *Bar Share Plough;* Edmund M. Waggenet, Adair county, Kentucky, January 12.

We have no doubt that the plough described is a very good one, but its appearance is much like that of many other ploughs; and although the patentee has placed it before us with much care, he has not told us in what his invention consists; he has, however, mentioned some of its good properties, and we will repeat after him, that "The plough is adapted to work with or without a coulter, and designed for fallowing, ridging, and ditching farm lands; draining marshes; turnpiking roads, and repairing highways."

"The projective slope of the bar and share gives to the plough a descending draft, which causes it to draw to and retain its hold in the earth to the depth regulated or required. The rolling board and face of the share forming a regular circle, and passing on at near right angles, *rolls, beds,* and *pulverizes* the earth at one and the same time. Placing the surface soil to the depth the plough runs, and bringing the clay, or sub-soil, upon the surface. All parts of the plough which are pressed by the earth being metallic, immediately scours smooth, cuts, slides, and rolls off the earth without friction or compression, which renders the draft extremely light; and from the combination of its parts, is rendered the more permanent by a hard draft."

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25. For an improvement in the *Percussion Lock for Cannon;* Enoch Hidden, city of New York, January 14.

In its general features this lock bears a strong resemblance to that patented by Mr. Joshua Shaw, of Philadelphia; but to lessen the powerful reaction upon the cock, or hammer, from the explosion, by which it is liable to be broken, that part of it which is immediately over the vent, has a hole drilled in it, to allow the explosion from the touch hole to pass through it. It has also a preventive spring, placed near the head of the cock, to ease it off in its recoil.

The claims are, the opening in the head of the cock; the mode of making the cock, as described in the specification; the preventive spring; a small steel or other metal tube to contract the vent hole; a piece of metal with leather or sponge, to place on the priming to keep it dry, or to close the vent when the gun is sponged, &c.

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26. For sawing boards by means of a *Double Toothed Saw;* Stafford Dawly, Annsville, Oneida county, New York, January 14.

At p. 10, (No. 70 in the list,) we gave a description of a saw with double teeth to saw timber by the moving of the carriage in either direction.

The present patent is obtained for the same thing precisely, and furnishes an example of what is perpetually occurring at the patent office. There is scarcely an instance in which any thing is patented which has the slightest air of novelty, that several do not claim to be the original and true inventors. We are aware that priority in the date of a patent is no evidence whatever of priority of invention. The real inventor is in general anxious to test the goodness of his plan, and whilst doing so, some of the numerous patent pirates with which many parts of our country are infested, catch the idea, and to those in this trade, an oath presents no obstacle to the attainment of their ends.

We know nothing about who is the inventor of the double saw; perhaps he has not yet come forward, and therefore our remarks are not at all individual in their character. Nor are they now made in consequence of the intrinsic merit of the present plan, as we think lightly of it on several accounts. The timber must be sawed entirely off at every cut, which in many instances cannot be done. The carriage has its bearing changed when its motion is reversed, and the boards will, in consequence, be sawed with less truth; and the teeth at each edge of the saw must be set equally open, and those which are not cutting will injure the face of the timber.

Three or four unmeaning lines constitute all that can be called a drawing in this patent; the object it is true can be well understood without a drawing, but the law claims one, and admits of no discretion on the subject.

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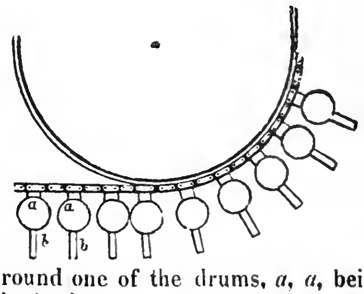
27. For improvements in *Navigation, and in the application of Steam, Men, Animals, or other Natural Agents, thereto;* William W. Van Loan, city of New York, January 15.

The essential feature of this plan is the passing of an endless chain of paddles over drums, in order to operate upon the water, in place of the ordinary paddle wheel. In this, taken simply, there is nothing new; but there are some particulars in which the plan proposed lays claim to originality.

The drums over which the endless chain passes are to be air tight, hollow cylinders, and each of the paddles, or keels, as they are called in the specification, is attached to a buoyant, hollow, water-tight vessel, running its whole length. In the accompanying sketch, the ends of the chain of paddles are shown passing round one of the drums, *a, a,* being the air-tight vessels, and *b, b,* the keels, or paddles.



The patentee says that, "in order to the more clear and full understanding of my invention, I further declare and set forth, that it rests upon the following principles."

"1st. In substituting for the paddle wheels, or other usual propelling apparatus, an endless chain of empty water-tight vessels, made to revolve upon appropriate drums or wheels, by steam, or any other prime mover whatever."

"2nd. In substituting for the buoyancy of the hull of a boat, or ship, the buoyancy of the immersed part of the endless chain of vessels, or when necessary, of hollow drums, or cylinders, or prisms, and the carrying forward any load they may bear, free from any resistance but that which they themselves experience. By these means getting wholly rid of the rapidly increasing resistance that fluids present to motion through them. I retain only a resistance whose measure is independent of velocity, and have thus in my power, theoretically, to obtain unlimited velocities: and, in practice, velocities limited only by the power of the prime mover that may be applied to the apparatus."

It is proposed to apply the same principle of buoyancy to the paddle wheels of team and steamboats, as an additional security against their foundering.

The whole description is written with much judgment and talent, but from what we know, and have seen, of attempts to propel vessels by endless chains of paddles, we anticipate no advantage from this part of the plan, when the test of practice is applied to it.

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28. For an improvement in the manufacture of *Saddles;* Levi Sherman, Bridgeport, Fairfield county, Connecticut, January 18.

In this saddle, nailing is substituted for sewing. The straining of the web, &c. is effected in the usual manner. The seat is drawn over and nailed fast. The skirts are nailed to the side bars.

Sometimes the skirts, or jockey, are made to meet in the centre of the saddle, and are seamed or stitched together; then stitched or seamed from one side bar to the other, and the skirts nailed on the side bars around the bellies of the saddle. The claim is to "the mode of making saddles by nailing instead of sewing the seams."

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29. For an improvement in the *Reaction Wheel;* John Turner, Augusta, Kennebeck county, Maine, January 18.

This patent is taken for an arrangement which is essentially the same with that claimed by Calvin Wing, the specification of whose patent was given in our February number, page 86. In the present specification the whole is imperfectly described; the part which Mr. Wing calls the *lighter* is here mentioned, and we are told that "this mode of relieving the wheel from the weight of the incumbent column of water, is what is specifically claimed as my invention."

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30. For *Stiffening Wool and Fur Hats and Caps* by the

use of India rubber, &c.; Laban L. Macomber, Gardiner, Kennebeck county, Maine, January 19.

(See specification.)

31. Machine for *Planting Onion Seed, all kinds of Garden Seed, Beans, Corn, &c.;* Peter Smith, of Chatham, and Theodore H. Arnold, of Haddam, Middlesex county, Connecticut, January 20.

This machine is to be driven forward like a wheelbarrow; it has two wheels united by a cylindrical shaft. Above this shaft two hoppers are placed to contain the seed; the cylindrical shaft fits against and closes the lower part of the hoppers; holes are bored in the shaft to form chambers, or receptacles for the seed, and they are to be larger or smaller according to the kind of seed to be sown. The hoppers may be more or less numerous; and the cylinder also may be varied. The claim is to "the arrangement and putting together of the various parts in the way and manner described, and the application of said machine in the form and method above described for the purpose of planting seeds."

32. For a mode of *applying the propelling power of water, steam, or any other known power, to mills or machinery;* Jehiel W. Dart, and Willard Webster, Truxton, Courtland county, New York, January 21.

The patent under the above title, is for one of those futile and worthless contrivances which are by no means rare in the records of patented inventions. That others may judge on this point as well as ourselves, we give the whole specification.

"Make a water wheel of a smaller diameter than the fly or balance wheel to be hereafter described. On the same shaft place a drum, pulley, or cog wheel, of the same diameter as the wheel first mentioned, or it may be larger or smaller. Make another wheel of a larger diameter than those before mentioned; and let it be connected by straps, belts, or cogs, to the last mentioned wheel. Let the gearing intended to be applied to mills or machinery work in this last mentioned large wheel, or into another wheel placed on the same shaft with it, and of the same size; or it may be larger or smaller as may be deemed most proper.

"The *invention* here claimed, and desired to be secured by letters patent, is the arrangement of the wheels as above described, by which the power originally applied to a small wheel, is communicated to mills or machinery by the intervention of another wheel or pulley, giving motion to a larger wheel."

JEHIEL W. DORT,
WILLARD WEBSTER.

Comment is entirely out of the question.

33. For a *Furnace for Heating Tyre;* Dudley Marvin, Canandaigua, Ontario county, New York, January 21.

The furnace is constructed in the form of a circular trough, usually of cast iron, formed in segments, the inner rim of the trough is small enough to admit the tire of the fore wheel of a carriage, and the outer rim sufficiently large for the hind wheel; a hollow channel passes round under the furnace; the plate which forms the top of this channel and the bottom of the furnace, is perforated with many holes, to allow wind to pass up from the channel. A large pair of bellows supplies this channel with air; charcoal is put into the circular cavity and ignited, and the tire placed upon it. The whole hoop is thus equally and rapidly brought to a red heat. Three minutes has served for this purpose, after the furnace had become heated. The parts are well adapted to the end proposed, and in large establishments we have no doubt that it will be found eminently useful.

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34. For *Propelling Machinery;* Thomas D. Newsom, Nashville, Davidson county, Tennessee, January 22.

Although this specification is writen in English, it might, for our use, as well have been offered to our comprehension in the language of Psalmanazer. On looking at the drawings, we perceived that the intention was to propel machinery by the vibration of a pendulum; the array of levers, wheels, and pinions, however, was too formidable to admit of our seeing through the design of the patentee, without resorting to his description, but after reading this, the darkness was only rendered the more visible. We could only discover that there was to be a double rimmed draft wheel; a double winged lever; a swing lever with a circled fork; two cranks on one shaft, and one somewhere else; two pitmen; a draft wheel; a drum wheel; a chain to work round two pulleys; two lever wheels; two speed cog wheels; a pulling wheel; two purchase levers; a gearing cog wheel; a fly wheel; a scape circle; and a number of other unmentioned and unmentionable parts, all of which are in some way, we do not know how, to be animated by means of a swinging weight, or pendulum, and is then to propel *steamboats*, rail-way carriages, and all kinds of machinery. In order to do this "there must be a seat on the end of the swinging lever, on which a man places himself, having a spring attached to the end of the carriage for the rider to place his feet against, to keep up the vibrating of the lever, propelling forward the vehicle."

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35. For an improved *Knife for Cutting Tobacco;* James J. Mapes, city of New York, January 22.

The claim is as follows.

"The invention here claimed, and desired to be secured by letters patent, is the above described case or stock, with the moveable steel blade, which can be renewed when worn, from time to time; the case remaining the same; whereas in the common method the knife is made all of one piece, and when the steel is worn the whole knife must be thrown aside."

The contrivance is something like that of a double ironed plane,

that is, the cutting knives of tobacco machines are to be made to set forward by means of screws tightening them upon slats.

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36. For a machine called the *Self-regulating Conduit,* for passing water around canal locks, from a higher to a lower level; James Clark, Westmoreland county, Pennsylvania, January 25.

(See specification.)

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37. For a *Bevel Wheel Plane, for Planing Boards,* &c.; Jonathan Newhall, Washington, Lincoln county, Maine, January 25.

Plane irons are fitted into the rim of a wheel, so as to cut on one face of it. Four, six, or any other number of irons may be used. The shaft of the wheel is to run in collars behind the cutting side, so as to leave the face unobstructed. The shaft has a sliding motion in the collars, to adapt it to stuff of different thicknesses. The wheel may be three feet in diameter, and its face is to be bevelled, so as to take off about half an inch on the edge, and to extend to two inches, or upwards, upon the face, according, as we suppose, to the width of the irons. The mouths of the planes may be made more or less open by means of plates of iron let in flush, but capable of sliding, so as to close the mouth when desired. These, of course, are to be tightened by suitable screws.

The timber is fixed upon a suitable carriage, and is to be moved along by a rack and pinion, or otherwise.

The claims are to "the bevel on the face of the wheel, the use of which is to admit the lumber to enter between the carriage and the verge of the wheel, and thereby present the part to be planed off to the action of the planes."

"The sliding motion of the wheel, by which various thicknesses may be planed."

"The running the lumber by the centre, and the metallic plates, the use of which is to answer the purpose of double irons, [by closing the mouths,] which principle is contemplated to be applied to hand planes."

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38. For an improvement in the common *Churn, and in the mode of working it;* Talmage Ross, Pickaway, Pickaway county, Ohio, January 26.

The dasher of the common churn is to be moved up and down by a lever, working like a pump handle. No doubt it will work.

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39. For an improvement in the *Sawing of Timber,* by water, steam, or any other power; Jeremiah Smith, Morris township, Morris county, New Jersey, January 27.

The saw frame, instead of working up and down between the fender posts, in the usual manner, moves in a curve, which the patentee terms an elliptical curve.

Two grooves are cut in each fender post, which are convex to-

wards their fronts. Projecting pieces at the upper and lower ends of the saw frame fit into these grooves, and as the frame is moved by the crank, the direction of the saw is, of course, governed by the grooves.

"The saw," the patentee says, "thus striking the timber, or log, to be sawed, first by the lower end of the saw, and by that means clearing the timber or log of saw dust, and thus removing that incumbrance from it."

"The patent is required only for the elliptical motion of the saw; the ellipsis to be varied according as it may suit the views of the applicant."

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40. For a *Rotary Pump;* Thomas Sutton, Norwich, New London county, Connecticut, January 28.

We have described several rotary pumps, and those who are conversant with hydraulic machines, are well acquainted with the principle upon which they in general operate. Toothed wheels taking into each other, or sliding valves variously constructed, are employed for the purpose of raising the water. In the present instance the sliding valves are used, and the mode in which they are moved is extremely ingenious, but a clear and adequate idea of the arrangement would require a view of the drawings. The great objection to most of these plans is a want of simplicity, which causes them to be difficult to make, and very liable to derangement by friction; we fear that these difficulties have not been overcome by the present patentee.

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41. For an improvement in the *Art of Tanning;* Osmond Cogswell, Cincinnati, Hamilton county, Ohio, January 29.

(See specification.)

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42. For a *Machine for Dressing Staves;* John G. Conser, Rebersburg, Centre county, Pennsylvania, January 31.

The stave is to be driven through an opening in a tool made of iron, or steel, the opening being of the size of the intended stave. This tool is to be fixed upon a block, and a ram, or driver, raised up by a pulley, and falling down between guides, is to force the stave endwise through the tool. The claim is to "the above machine for shaving or dressing staves."

To the judgment of the cooper, we must leave the estimation of the value of "the above machine." Were we to venture an opinion upon so recondite a subject, we should say that such a machine might reduce staves all to one width and thickness, but that it would neither straighten them, or dress them, in the technical acceptation of the term.

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43. For Machinery for *Cleaning Wool from Burs* and filth by means of Steel Combs, while the wool remains on the

skin; Lewis L. Miller, Rochester, Monroe county, New York, January 31.

A cylinder, resembling the large cylinder of a carding machine, is to have on it a number of rows of steel teeth about five-eighths of an inch in length; to this cylinder a revolving motion is to be given. A second cylinder, about a foot in diameter, is placed parallel with the former, and slides to and from it on a carriage. The skin to be cleaned is to be put upon this smaller cylinder, and fixed to it at one edge by a moveable strip. The feeding, or smaller cylinder, may be turned by means of a crank, the hand graduating it as may be necessary. The mode of using it will be obvious from the foregoing description.

"What the inventor relies on in this improvement, is in applying the combs in this way to cleaning sheep's wool from burs, cockles, and other filth common to wool, making the same article more valuable in market, at less than one-fourth of the common expense in cleaning."

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44. For a *Washing Machine;* James Hinkley, Fayette, Kennebeck county, Maine, January 31.

A curved segment, formed of rollers, and a pendulous, or vibrating, rubber adapted to them, and having spiral springs to adjust it, are to operate within a tub or trough.

The patentee tells us that, "Although rubbers and rollers of various descriptions have been entered into machines, constructed for the purpose of cleansing or washing clothes, yet, I allege that the foregoing describes a new arrangement or construction of the parts, constituting a new conformation, and producing the effect by a mode of operation entirely new, and therefore claim it as my invention."

"He must have optics good, I ween."

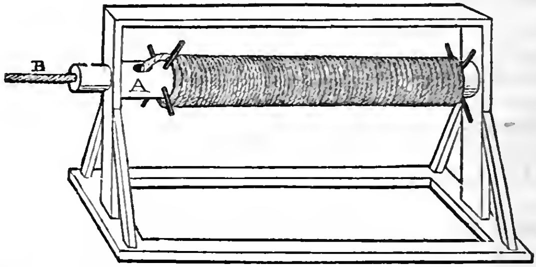
Specifications of American Patents.

Specification of a patent for an improvement in the manufacturing of Ropes. Granted to Edward S. Townsend, *and* Philo Durfee, *Palmyra, Wayne county, New York, January* 6, 1831.

This machine is composed of a shaft, or reel, used in place of a wheel or crank, to give the twist or turn for laying strands or rope; so that a strand or rope can be twisted or laid in certain lengths at a time, until a rope or strand is twisted or laid of any required length. The shaft to be fixed to revolve on proper supports, (in boxes, or gudgeons, &c.) made of proper materials, with a hole passing into the side and out at the end, so that when a rope or strand is coiled on the shaft, the end of it can pass through the eye thus made in the end of the shaft, not interfering with the supports; thus giving a chance for spinning to it another length of yarn; then the shaft being turned, gives the turn for the laying of strands or rope, which, when so laid, is again to be reeled, leaving the rope out as

before: thus on-laying, and spinning, until any required length is finished. The chief object is to make a rope of any assignable length in one piece, by laying it in portions of convenient length, and spinning into the threads of the end of such parts as is already laid. In laying several ropes into a layer, or tarred yarn into a rope, the reels or machines must be equal to the number of strands and rope, and may remain stationary, or be placed on slides, or truck wheels, as may be necessary.

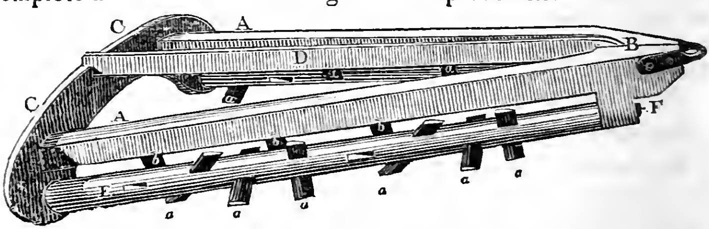
EDWARD S. TOWNSEND,
PHILO DURFEE.



A, shaft. B, rope passing out at the end of the shaft.

Specification of a patent for an improvement in the mode of making Harrows for the purposes of agriculture, called Revolving Harrows. Granted to SAMUEL RUGG, *Lancaster, Worcester county, Massachusetts, January* 11, 1831.

THIS improvement in the harrow is more particularly described as follows, and I refer to the drawings of the same accompanying this specification, and the model deposited in the office, for a more complete and full understanding of the improvement.



In the drawing, A, A, are two horizontal bars forming a triangle, and joined at B.

B, is the forward part of the harrow.

C, C, the junctions of the bars at the other end of the frame and with A, A, and B, constituting the whole frame.

D, a brace running from B, to a middle point between C, C, and is also extended as a runner when the harrow is turned over on its back, for the purpose of being drawn over the ground without obstruction.

E, E, are two cylindrical rollers which come near together at the point F, and revolve at each end on their axes. These cylinders diverge till they reach the part of the frame C, C, where they are inserted, and may be made to constitute, at pleasure, either a greater or less angle than A, A.

a, a, a, &c. are iron teeth, part of which are visible in the drawings. These teeth are mortised into the rollers, the same number in each roller, and pass entirely through, and have sharp edges, with backs, resembling in some degree the blades of penknives, and varying in size with the size of the rollers and frame. These teeth may be grooved, or made concave on one side, or may be of plain surfaces.

b, b, b, &c. some of which are visible in the drawing, are pieces of iron inserted in A, A, and extending downward towards the rollers, for the purpose of clearing them from sods, earth, or other obstruction.

The mode in which this harrow is worked is as follows. The power is applied at the end near to B. The rollers are thus immediately put in motion, and continue revolving in opposition to each other; that is, revolving in opposite directions, and outwardly from the frame on either side. This improved harrow is very useful in cross furrowing, and particularly so in subduing rough land, and soils that are stubborn, either from roots, or otherwise; and breaks up and mellows the land with great advantage. It is also easier for draft than the common harrow of the same size.

The principle to be secured is the revolving principle as applied to the harrow. The form is of less consequence. The petitioner contemplates the use of his improved harrow in other forms; for instance, the bars A, A, may be brought nearer together than C, C, or may be entirely removed, and D only retained. E, E, may be made to diverge more or less, or work in parallel lines, and revolve either way by varying the form of the teeth; and a single roller may be used with a handle at the end opposite to the draft, for light harrowing, or cross furrowing. SAMUEL RUGG.

Specification of a patent for an improvement in the composition of Matter used in stiffening wool and fur hats and caps, by the use of Indian rubber, (elastic gum,) either in combination with gum shellac, or alone. Granted to LABAN L. MACOMBER, *Gardiner, Kennebeck county, Maine, January 19th,* 1831.

BE it known that I have invented a new and useful improvement in the composition of matter to be used in stiffening wool and fur hats and caps, by which they are rendered so elastic as to be folded into a small compass, and packed with clothes in the trunk of the traveller, or elsewhere, as convenience may require; after which they can be made to resume and keep their original shape; by using elastic gum, (Indian rubber,) either in combination with the gum

shellac, or alone. If used with shellac, I dissolve the elastic gum in spirits of turpentine, or any other suitable solvent, and the shellac in alcohol, or any other agent proper to dissolve the same. If used alone, I dissolve the elastic gum aforesaid in spirits of turpentine, or other solvent.

What I claim as my invention is, the use of gum elastic, either alone or in combination with gum shellac, as aforesaid, in stiffening wool and fur hats and caps, so as to render them elastic to such a degree that they may be folded and packed, and then restored to their usual shape aforesaid, and also to render them water proof.

LABAN L. MACOMBER.

Remarks by the Editor.—A patent was obtained in England, some years since, for applying gum elastic, in combination with shellac, and other resins, to the stiffening of hats, and rendering them water proof. We do not now think it necessary to turn to the patent; but if any one doubts the correctness of the assertion, we will do so, and, if desired, publish the specification.

Specification of a patent for a machine called the Self-regulating Conduit; for passing water around canal locks, from a higher to a lower level. Granted to JAMES CLARKE, *Westmoreland county, Pennsylvania, January* 25, 1831.

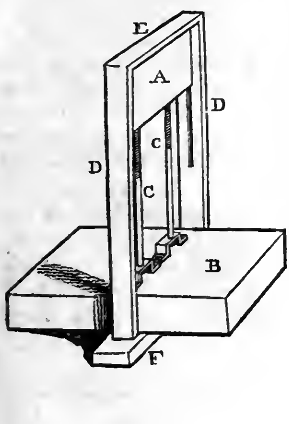
THE bottom of the conduit, connecting with the upper level of the canal, must correspond with the bottom of that level, and be carried to such a point between the upper and lower levels of the canal as shall be found most convenient for the construction of the regulating gate; the lower level of the conduit must be on a plane with the lower level of the canal, or may be sunk as much lower as the particular circumstances of the case may require. The dimensions of the conduit must be regulated in proportion to the quantity of water which it is intended to vent. At the connexion of the two levels of the conduit, the regulating gate must be placed, and constructed in the following manner.

Two, or more, mud sills are framed together, and are placed horizontally at the bottom of the lower level of the conduit, into which two upright gate posts are placed, one on each side of the conduit, and extending from the bottom of the lower to the top of the upper level; these posts to be supported by a cap sill, braces, and longitudinal frame work, covered with plank extending each side of the gate, so as to conduct the water towards the gate, and to serve as an apron to convey the water over the air box, buoy, or float. A groove or rebate must be cut in each of the gate posts, so as to receive the gate, and extending from the top of the posts downwards, a sufficient distance, to admit the top of the gate to be drawn down to the bottom of the upper level of the conduit. When the size of the gate shall be such as to prevent it sliding easily in the grooves,

or rebates, metals, boxes, or friction rollers, will be placed so as to admit a free action of the gate.

The gate must be constructed of plank well jointed and secured together, and be of a height corresponding with the greatest depth of water intended to be maintained on the upper level. This gate is connected with an air box, buoy, or float, placed in the lower level, which box, buoy, or float, must be of a size and buoyancy sufficient to raise the gate as the water shall rise in the lower level. This box, buoy, or float, is connected with the gate in the following manner. Two, or more, screws, are required with flat heads, resting on the top of the box, buoy, or float, and secured to it by metal plates, having holes in them sufficiently large to admit the shank of the screw to pass upwards through them. When these plates are fastened to the box, buoy, or float, the heads of the screws will turn under them in the manner of a swivel. Holes corresponding with the screws must be bored in the lower edge of the gate, and be of sufficient depth to admit the box, buoy, or float, and the gate to be screwed together, or apart, so as to maintain any required quantity of water on either level. Screw nuts must be placed in these holes so as to govern the gate. The screws are provided with holes in their shanks, near the box, buoy, or float, to admit the end of a turning bar or lever, for the greater convenience of working them. When it is intended to maintain a greater quantity of water on the upper than the lower level, the gate must be screwed from the box, buoy, or float; when the greater quantity is required on the lower level, the gate must be screwed towards the box, &c.—The operation of the machine will be as follows. The water, in passing the conduit, will flow over the top of the gate into the lower level; as the water rises in the lower level, the buoyancy of the box, buoy, or float, will force the gate upwards until the required quantity is obtained in the lower level, when the upper section of the conduit will be closed by the gate. Should the water sink in the lower level, the weight of the box, buoy, or float, will draw the gate downwards, so as to admit the water to pass over its upper edge, thus producing a regular supply, and such depth of water in the canal, at all times, as may be desirable.

JAMES CLARKE.



A, regulating gate.
B, air box.
C, C, screws.
D, D, gate posts.
E, cap sill.
F, mud sill.

Specification of a patent for an improvement in Tanning. Granted to OSMOND COGSWELL, *Cincinnati, Hamilton county, Ohio, January* 29, 1831.

THE improvement consists in applying a solution of oak or other bark to hides or skins, in such manner, as that when the glutinous particles of the hide have absorbed and become mixed with the tanning, or astringent principle, the other part of the solution (viz. the water,) may pass off and leave the hide free to receive more of the solution, and so on till it is tanned. The object is to expedite the process of tanning, and consequently to diminish the amount of capital necessary to be employed in the business.

The *apparatus, and mode of application* is as follows. Make a frame of timber of a square form; the width to be made as great as the width of the hides, parts of hides, or skins, that are to be tanned; the height and length to suit convenience. Near the bottom, or ground of said frame, a tight floor is to be formed of the length and breadth of the frame; said floor to incline to one side so as to carry off the liquor after it has passed through the hide; the sides and ends to be raised from two to four inches above the floor, by fastening strips of plank on the inside of the frame; this will appear like a box; say four feet wide, two inches high on one side, and four on the other, and twenty feet long; (these boxes may be fixed one above another, about twelve inches apart to the top of the frame;) said boxes to be filled with *saw dust*, or any other soft porous substance, that will not prevent the solution from running through the hide, and at the same time absorb and carry it off after it has passed through. On this surface, (of saw dust,) the hides, sides, or skins, (after having been prepared in the usual mode for tanning, except that the flesh is to be taken off clean,) are to be smoothly spread out, and in order to keep on them a sufficient quantity of the solution, make sacks of coarse cotton or other cloth, an inch or more in diameter; fill them with the same material that the boxes are filled with, and place them around under the edges of the hides, which will raise said edges equal to the diameter of the sacks. After this is done, pour on the hides as much of the solution as the hollow surface which they will then present will hold, and continue to fill them up as it runs off through the pores of the hide, for the space of from three to fifteen days, (the time in proportion to the thickness of the hide or skin,) in which time they will be tanned, except the extreme parts or edges, which cannot be brought so fully under this process as the other parts of the hides: and in order *perfectly* to tan *them*, it is necessary to lay them in vats after the common mode, for three or four weeks.

OSMOND COGSWELL.

Specification of a patent for an improvement in the process of Distilling. Granted to James L. Jenks, Sacket's Harbour, New York, May 2nd, 1831.

To all whom it may concern, be it known, that I, James L. Jenks, have invented an improvement in the process of distilling, by which alcohol, or spirits of any desired proof, may be obtained at one operation, and that the following is a full and exact description of my invention, and the manner of carrying it into effect.

The separation of ardent spirits from water, or from vinous liquids, by distillation, in whatever way the process may be performed, depends upon the different degrees of heat at which these fluids are converted into vapour; and the strength of the spirit obtained, is governed by the manner in which the condensation of the vapour is effected. My invention consists in an improved construction and arrangement of the condensing apparatus, by which the whole, or nearly the whole, of the water which rises in vapour with the spirit, is condensed and returned into the still, whilst the whole, or nearly the whole, of the spirit, is subsequently condensed, and passes over into the proper recipient.

For the purpose of giving a clear view of my apparatus and mode of procedure, reference may be had to the annexed drawing. In this, A, represents the arch and still, with the usual appendages, having a boiler for the use of steam. The still, as shown, I have converted into a spirit still, by putting a stopper through the supply pipe, B, near to the supplyer, C, and inserting another pipe, a segment of which is shown at D. This pipe leads up to a reservoir from which the still may be supplied with spirit. At the bottom of the supplyer, C, there is a valve, regulated by a float in the still, an arrangement well known to those who distil by steam. The tub E, contains the ascending worm, to be presently described. This worm may vary in length and size, but it is best when made of about one hundred feet in length, and having a bore of about three inches at its lower end, and for one half of its length; and of about two inches in its upper half. F, is the ordinary condensing worm and tub; G, the recipient; H, the platform on which the tubs stand; and I, the penstock for supplying cold water, with the arms or tubes attached to it.

The beak of the still, or the tube, J, has a slight ascent, as it proceeds from the still to the ascending worm. The tub, E, is filled with water, the temperature of which I elevate to 176 degrees of Fahrenheit's scale, and sometimes higher, depending upon the strength which is intended to be given to the spirit. To heat the water in this tub, I first charge the still with water, the fire is then raised, and the vapour from the water will produce the desired effect, the heated water is then drawn off, and the still charged as usual.

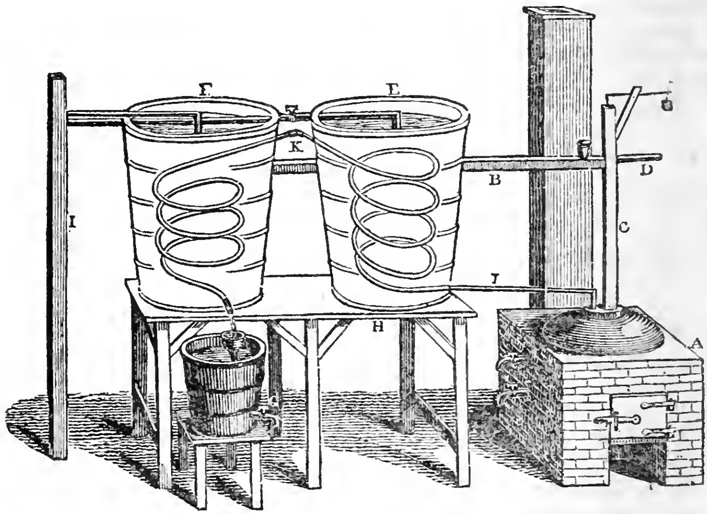
The upper end of the ascending worm, and of that in the refrige-

ratory, F, are connected together, as shown at K. The water will by this means be nearly, or entirely, separated from the spirit.

It is not absolutely necessary that the beak of the still should be connected with the *lower* end of the worm in the tub which contains heated water, as the same effect may be produced by connecting it with the *upper* end, and the connecting the lower end of this worm with the final condenser; attaching a tube at the junction of the two in such a manner as shall enable it to return the condensed water, or wash, into the still. Such an arrangement I consider the same in principle with the former.

What I claim as my invention, and for which I ask a patent, is the placing of the tempered refrigeratory, with its worm, between the still and the usual condenser, in the manner and for the purposes set forth in this specification.

JAMES L. JENKS.



Remarks by the Patentee.

It is not pretended that either time, or fuel, is economized by using steam as the prime heater, in converting spirits, already distilled, into alcohol; but, so far as regards the use of steam, my object is to enable the distiller, who already uses steam in the process of distilling the low material, to draw off his spirit as high as he pleases, at a single operation. I have made many experiments upon this point, all confirming the correctness of the principle upon which I have proceeded. The apparatus which I have in use, however, has an ascending worm of only seventy feet in length, whilst it ought to be one hundred, with a bore of only two inches. The consequence of which is, that the spirituous vapour passes over the apex, when the refrigerator is at a temperature lower than that at which spirits boil.

In an experiment made with water only, to ascertain what must be the temperature of the refrigerator to allow its vapour to pass over, not a particle was obtained until the temperature was 186°, and but a minute quantity at 196°.

When I mixed two quarts of spirit with 150 gallons of water, the spirit came over when the refrigerator stood at 170°; but owing to the small proportionate quantity of spirit, the quantity eliminated was insufficient to fill the worm, the ingress of atmospheric air, at a damp season, had, consequently, the effect to reduce it to 71 per cent. above proof, by the New York standard hydrometer.

I charged my tub with 104 gallons of proof spirit, the refrigerator standing at 164°. Spirit came over immediately after boiling. Some samples taken were 90 above, and after drawing off 45 gallons, with the refrigerator varying from 164° to 168°, the whole, when mixed, was 85 per cent above. I then changed casks, turned my temperature regulator, and allowed the refrigerator to run up, and when the remainder of the spirit was drawn off, it was 73 above.

It may be perceived, therefore, that by this simple process, alcohol is readily obtained from a very low wash, without the use of alkali, or any other agent having an affinity to the water, and that at a single operation.

Documents relating to the Royal Ordinance of France, (1823,) *concerning High Pressure Steam Engines.*

[TRANSLATED FOR THIS JOURNAL.]

(Continued from page 279.)

Circular of the 19*th of May,* 1825, *to the Prefects of Departments.*

I HAD the honour to transmit to you, in conformity with the 8th art. of the ordinance of October 29th, 1823, instructions in relation to the measures of precaution to be observed in the use of high pressure engines.

Scientific questions of importance, requiring numerous and accurate experiments, and the assistance of the Academy of Sciences, were to be resolved in order to the preparation of a second set of instructions, relating to the proof to be borne by boilers, previous to their use, and to the fusible disks with which they are to be provided.

These instructions are now transmitted to you; they have been drawn up by the Board of Engineers of Mines, and of Civil Engineers, which was assembled to put in execution the ordinance of October 29th, 1823; and have been approved, May 7th, by his excellency the Minister of the Interior. I inclose — copies.

You will find, accompanying this,

1st. A table of the elastic force of steam at different temperatures, drawn up by the Academy of Sciences.

2nd. The ordinance of October 29th, 1823, in relation to high pressure engines.

As an acquaintance with these documents is indispensable to the manufacturers of high pressure boilers, and as they interest those who use the engine, I request you to send copies to both these classes of persons, so that they may not be ignorant of any of the articles to which they are obliged to conform.

The numbers in the table* referred to, are only approximate. The Academy of Sciences is of opinion that the temperatures corresponding to the elasticities, are not more than two or three degrees from the truth, even in the highest parts of the table; so that no practical inconvenience need be feared, in following the measures of precaution.

The Academy is now engaged in the experiments necessary to make this table accurate, and also to determine the dimensions which should be given to safety valves. I will communicate their results as soon as the experiments are concluded.

You know that if there is no resident engineer of mines in your department, the government civil engineer must, according to art. 7 of the ordinance, supply his place, and superintend the proving of boilers, and of their fusible plates. This engineer should visit every work, at least once a year, examine the boilers which are in use, and induce the removal of those, the use of which he may consider dangerous.

I request you to inform the makers of high pressure boilers, and those who use them, who are obliged, by the terms of the ordinance, to have boilers proved and marked, that they must apply to you, that you may direct them to the engineer who is charged with such duty, and may give, at the same time, to this engineer, the necessary instructions.

When you shall have informed me that there are works for manufacturing boilers, in your department, I will send you,

1. A die to stamp the fusible disks; also, a second die, in case of accident to the first, or to supply an adjacent arrondisement.

2. A die, having a *fleur de lys* sunk upon it, with which to mark the screws attaching the fusible plates to the boiler. (There will also be a second die of the same kind.)

These dies will be placed in the keeping of the engineer.

I send you three models of each die. One of them will be deposited in the archives of your department, the others will be sent to the engineer charged with the inspection of boilers.

If more of the articles sent are wanted, for the different arrondisements of your department, I will send a further supply, upon your requisition.

You will not forget that the 7th art. requires of the local police, a constant surveillance of the works where high pressure engines are used.

In case of an infringement of the ordinance, the proprietors of the works will be liable to their stoppage, without prejudice to the penalties which may be awarded by the courts.

* The use of this table having been superseded by the publication of one, drawn from the recent experiments of Arago and Dulong, it is not appended to this translation.—[Translator.

It is your duty, Mr. Prefect, to make such arrangements for this surveillance as may seem most proper to you. Human life depends upon the observance of the ordinance and instructions, which have the further object of securing manufacturers from serious losses.

I request you to see to the execution of the rules prescribed by the ordinance and instructions, and to acknowledge the receipt of these.

(Signed,) BECQUEY.
Counsellor of State, &c.

Second Set of Instructions in relation to the execution of the Royal Ordinance of October 29th, 1823, concerning High Pressure Engines.

THE royal ordinance of the 29th October, 1823, requires that no boiler shall be sold, much less used, until it has been provided with two safety valves, and two disks of fusible metal, and also has been proved by the hydraulic press, and marked after the proof.

Those makers of high pressure boilers who may have boilers to be proved, will inform the Prefect of the same, who will transmit the information to the engineer of mines, residing in the department, or else to the government civil engineer, who is to supply his place. (Art. 7 of the Ordinance.)

The Prefect will take care that these operations, relating to the proof, are conducted with as little delay as possible, that no inconvenience may result from them to the arts. The engineer will ascertain, first, if the safety valves are of the proper dimensions. He will ascertain also, if the apertures to be covered by the fusible plates are of the proper sizes; that is, if one has a diameter at least equal to that of one of the safety valves, and the other at least twice this diameter. He will further satisfy himself that the position of these plates is such that they will fulfil their object.

The boiler will not be proved until after the fusible plates are applied. The fastening of the plates to the boiler will be preceded by the operations now to be described. The engineer must determine from the table hereunto annexed, the degree of the thermometer at which the metallic plate to be used, must fuse. He will next ascertain whether the metal proposed to be employed has the requisite fusibility; this may be verified in two ways.

1st. If the metal has been prepared by the maker of the boiler, the engineer will proceed to determine the temperature at which each of the ingots to be employed will fuse, using the apparatus employed by the maker for the purpose, if he is satisfied of its accuracy.

2nd. If the metal is that used in commerce, the engineer will merely satisfy himself that it bears the legal stamp designating its fusibility, which has been affixed, by the engineer of mines intrusted with making such trials, in the manufactory of the metal: this stamp will be of the kind spoken of in the next paragraph.

The engineer, having ascertained that the alloys, of which the plates are to be made, fuse, at 18° F. and 36° F., respectively, above the temperature of the steam of ordinary working pressure, will have

the two disks cast in his presence, and will place upon each an octagonal stamp with the motto, "Civil Engineers of Mines;" and in the middle of this stamp he will have, immediately, engraved the degree of fusibility of the disks. The disks will then be fixed upon the boiler.

If the maker of the boiler shall have procured disks already tried and stamped, the engineer will have no other trouble than to examine the stamps, indicating their fusing points, before having them affixed to the boiler.*

The engineer should attend to the fact that he is not in search of the precise temperature at which the plates fuse, but of that at which the plate becomes so soft as to yield to pressure. This distinction is important, because the plates of fusible metal lose their tenacity before they melt. The stamp should therefore denote, not the temperature of perfect fusion, but that which softens the metal so much that it will give way to a pressure corresponding to this temperature.†

The boiler tubes having been attached to the boiler, as well as the fusible plates and the safety valves, (duly loaded,) the boiler must be filled with water, and proved by means of a forcing pump, or of a hydraulic press, to be furnished by the manufacturer, who shall also provide the labour necessary to its use.

The proof pressure must be five times that at which the engine, to which the boiler belongs, is to be worked; for example, if the boiler is to contain steam of two atmospheres, the proof pressure must be carried to ten atmospheres.

When the boiler may have resisted such a pressure, the engineer shall have it marked, in his presence, with the number showing in atmospheres the pressure under which the boiler is to be worked.

The apparatus for marking shall consist, first, of a circular plate of copper, struck at the mint of Paris, bearing an inscription, *Ordinance of October 29th*, 1823; upon this the number of atmospheres and half atmospheres, shall be marked; 2nd, of three screws, of the same metal, intended to fasten the plate to the boiler. After the screws have been inserted and tightened, the engineer shall have the head of each cut off even with the plate, so as to erase the groove on the head. He shall then have a fleur de lys stamped upon each head by a die larger than the head itself.

The plate and screws shall be furnished by the manufacturer.‡

By means of the method just described, all high pressure boilers will be proved where they are manufactured, which will confine the proving to a few departments.

If there is no manufactory of boilers in a department, the duties of the engineer, in relation to boilers, introduced into the depart-

* Manufacturers will find fusible metal, prepared according to the directions of M. Gay Lussac, Member of the Royal Academy of Sciences, at the store of M. Collardeau, &c.

† In this paragraph, the great advantage of the fusible plate over the safety valve, viz. that it yields by the effect of temperature, and not of pressure, seems to have been lost sight of: to have followed such a direction to the letter, would have been to reduce the efficacy of the plate most materially, by depriving it of the power of guarding against the explosions resulting from a defective supply of water within the boiler.—[Trans.

‡ Manufacturers may procure them, at cost, at the Royal Medallic Mint, &c.

ment, either for the use of high pressure engines already licensed, or which may hereafter be licensed, will be limited to ascertaining that they have the two proper marks. This can easily be done by means of the models.

One of these models is deposited in the Archives of the Prefecture, the other in the office of the Engineer of Mines, or in that of the Government Civil Engineer.

(Signed,) Becquey, *Counsellor of State, &c.*

Approved.

(Signed,) Corbiere, *Minister of the Interior.*

Paris, May 7th, 1825.

On the first invention of Telescopes, collected from the notes and papers of the late Professor Van Swinden. *By* Dr. G. Moll, *of Utrecht.*

The late Professor Van Swinden had been at considerable pains to illustrate some important points in the history of natural philosophy. The first invention of telescopes in Holland attracted a considerable share of his attention, and he had the good fortune to meet with some official documents, which are calculated to throw some light on the mystery in which the early history of this celebrated invention is involved.

Mr. Van Swinden exposed the result of his labours in several public lectures, and he intended to publish a paper on the subject: his death prevented the accomplishment of this purpose. He left, however, the sketches of his lectures, together with extensive notes, and abstracts from various writers, which he had collected with great industry. These papers were committed to my hands, and the result of what I collected from them has been ordered to be printed by the Royal Institute of the Netherlands.

The little which is known of the first invention of telescopes in this country has been principally derived from two sources: first, from the book, which the French physician, Pierre Borel, wrote on the subject in 1655, probably at the request, and certainly with the assistance, of William Borel, at that time ambassador of the States at the court of France.* The second source from which information is generally derived, is a passage in Descartes's Dioptrics,† in which he attributes the invention to a citizen of Alkmar, called James Metiús. Both the versions of Borel and Descartes are usually given in books written on this part of natural philosophy, and very

* De vero Telescopii inventore, cum brevi omnium Conspicilliorum historia, authore Petro Borello, Regis Christianissimi consiliario et medico ordinario; Hagæ Commit. ex typogr. Adriana Vlacq. 4to. 1655. Pierre Borel was a native of Chartres, and author of several other books: he died 1689. A copy of this very rare tract has been recently added to the library of the Royal Institution. It contains a portrait of Lippershey.

† Cartesii Dioptrica, p. 49.

recently they were repeated in the very excellent account of the life of Galileo, published in England, and in the still more recent and capital work of Professor Littrow on Dioptrics.

The real name of this Metiús of whom Descartes speaks, and who is also mentioned by Huygens, was Jacob Adriaansz. His father Adriaan Anthonisz was a man of considerable knowledge for his time; he possessed a great influence, and took a principal part in the struggle with Spain. In consequence, he was banished by the Duke of Alva, and his property confiscated. He contributed very essentially to the glorious defence of his native town against the Spaniards in 1592. He was created afterwards inspector of fortifications, and many towns were fortified on his plans. As a mathematician he is celebrated for his expression of the ratio of the diameter and circumference of the circle, by the numbers 113 and 355. At that time Ludolf van Ceulen had not given his celebrated number, and the ratio of Archimedes, of 7 and 22, was in general use. The numbers of Anthonisz have the merit of being easily kept in memory, and of being as accurate as almost any purpose requires. If no logarithms are used, it is easier to calculate than Ludolf's number.

There is another problem remaining of this Anthonisz, which shows his ability as a mathematician: it is recorded in one of the writings of his son Adrian, and Delambre notices it in his history of astronomy. The problem was solved by Nicholas des Muliers of Bruges, then professor of mathematics in Groningen.

All the four sons of Adriaan Anthonisz were mathematicians like their father. The eldest, Dirk or Theodore, was an engineer and surveyor in the service of the States. He sailed in that capacity in the expedition against the Spanish colonies in the West Indies and the coast of Africa, sent out under Admiral Peter Van der Does in 1599. He died in that ill-fated expedition.

The second son, Adrian, whilst at the University, had the nickname of *Metiús* given to him by his fellow students, on account of his propensity to mathematics. He became generally known under that name, and wore it through life. His father sent him to Hueen to study astronomy under the celebrated Tycho, and afterwards he visited several universities of Germany. He filled the astronomical chair at the university of Franeker with great credit, and died in that place in 1635. His works were very numerous and celebrated in their time, being considered the best elementary works then extant. Delambre seems to have known only one of Metiús' books, of which a complete catalogue is to be found in Vriemoet.*

The fourth son, Anthony, did not rise to such extensive fame: however, he also served his country as an engineer.

The third son is the person whom Descartes designates as the inventor of the telescope. His name was Jacob Adriaansz; and sometimes the name of Metiús, which properly belonged to his brother, was given to him. This Jacob or James, died between 1624 and 1631. Contemporary writers describe him as a person of eccentric and fanciful habits, buried incessantly in deep meditations, and of a temper so little communicative that he very seldom spoke to

*Athenæ Frisiacæ.

any one about the subject of his studies. It is well known that such an eccentric turn of mind is not incompatible with mechanical genius, and in England and elsewhere the most consummate skill has often been blended with most singular habits. It appears, from the evidence of writers of that time, that this Jacob had acquired considerable skill in working glass, and excelled, amongst other things, in the construction of large burning lenses. It is said that he once placed a large lens on the walls of Alkmar, and predicted that at a certain hour of the day it would set fire to a tree standing at a great distance on the other side of the moat. At the request of Prince Maurice of Nassau, who was a great proficient in mechanics and mathematics, many and pressing solicitations were made to make Jacob explain how this, and other apparatus which he contrived, were executed; but he obstinately rejected all offers, and always refused to give the least information, even on his death-bed, when strongly urged by a clergyman, at the request of his relatives. It must be allowed that at that time, and even now, the construction of a burning lens of such power was a matter of great difficulty, and even at present very few artists would be capable of doing the same. So strong was his desire to conceal his inventions, that before his death he caused his apparatus and tools to be destroyed.

This eccentric character sent a petition to the States General of the United Provinces, dated 17th of October, 1608. An original copy of this document, made by a public notary in the most authentic form, is existing in the library of the university of Leyden, amongst the manuscripts of Huygens. In this document it is distinctly asserted that this person actually invented the telescope. He calls himself Jacob Adriaanszoon, son of Mr. Adriaan Anthoniszoon, and he goes on to state, "that since two years, he employed all the time which he could spare in inquiring into some occult or secret arts connected with glass making. That he found that, by means of a certain instrument which he was making for another purpose, the sight of persons using it might be extended, so as to make objects which, on account of their distance, could not be seen or only distinguished with great difficulty, appear near and distinct. That since that time he applied himself to bring this invention to greater perfection, in which he succeeded so far as to make an object appear as visible and distinct by his instrument as can be done with *that which was lately offered to the States by a citizen and spectacle-maker of Middleburg*. That his excellency, (Prince Maurice,) and others who compared the instruments, convinced themselves of this fact, notwithstanding that his instrument was made of only coarse materials, and merely for the sake of experiment. That he has no doubt but that the contrivance, by improving the engine, might be brought to greater perfection, but that, besides, he believes and hopes to improve, in time, *the invention in itself*, so as to make it capable of doing great service. That he apprehends that, in the meantime, other persons might imitate his invention, building on the foundations which he had laid, by the grace of God, with his *ingenuity, great labour, and intense study*, and by these means might frustrate

him, and rob him of the fruits of this invention, which he has a right to expect with great confidence; and therefore, he prays their High Mightinesses to grant him a privilege (*octroi,*) by which every one, *not possessing the said invention at present*, is prohibited from imitating this instrument, or even from selling or purchasing instruments made contrary to this privilege, without his express leave, and on a fine of a hundred florins on each instrument; and that this privilege is to last twenty years, or, instead of a privilege, to allow him such a remuneration as will be adequate to the utility and service likely to be derived from this invention."

In the margin of the petition the following appointment is written: "The petitioner is exhorted to make further investigations, to bring his invention to greater perfection; when his prayer for a privilege will be taken into consideration."

"*Actum*, 17 *October*, 1608."

With the signature of "Aersens," the then Secretary of the States.

If we are disposed to give full credit to Adriaanszoon, whom, for brevity sake, we will call *Metiùs* in future, it appears that he began the researches which led him to the invention of the telescope as far back as 1606; that the invention was due to chance, and occurred while its author was trying other experiments; that he spent subsequently much time and labour upon it; but that in 1608, when he sent in his petition, his instrument was made of bad materials, and might be much improved. At the same time he readily admits that another person, *a spectacle-maker of Middleburg*, had offered before him a similar instrument to the States, which had been tried by Prince Maurice and other persons, and he gives us to understand that his instrument is equal to that of his competitor. Nothing is said which enables us to judge of the performance of either instrument.

Mr. Van Swinden examined the written Acts and Journals of the States General of that time with great care. These papers are kept at present among the state archives in the Hague. Under the date of the 2nd October, 1608, the following entry is made:—

"*Jovis*, 2 *October*, 1608.

"On the petition of *Hans Lippershey*, a native of Wesel, an inhabitant of Middleburg, spectacle-maker, inventor of an instrument for seeing at a distance, as was proved to the States, praying that the said instrument might be kept secret, and that a privilege for thirty years might be granted to him, by which every body might be prohibited from imitating these instruments; or else to grant him an annual pension, in order to enable him to make these instruments for the utility of this country alone, without selling any to foreign kings or princes. It was resolved, that some of the Assembly do form a committee, which shall communicate with this petitioner about his said invention, and inquire of him whether it would not be possible to improve upon it, *so as to enable one to look through it with both eyes;* and further, to inquire what remuneration would satisfy him. And due report being made, it will be laid in delibera-

tion, whether it is expedient to grant to the petitioner a remuneration or a privilege."

From this document it appears who this inventor was, whom Metiús designates in his petition of the 17th of October, and whom he allows to have anticipated him in presenting a telescope to the States: it was the spectacle-maker of Middleburg, born at Wesel, and called Hans, *i. e.* John Lippershey. This man offers to keep his invention a secret; and he intimates a belief that it might be of service. This story offers also a ludicrous instance of the strange vexations to which ingenious men must often submit, from ignorant but official persons; this is—

> "The insolence of office, and the spurns
> That patient merit from the unworthy takes."

Here comes Lippershey, tendering to the States an invention, which, in its further progress, is entirely to alter and to extend all our notions of the universe—an invention which bodes a complete revolution in navigation and astronomy, and the first thing which these wise men think of, is to lay the inventor under the obligation of making a telescope through which *one could see with two eyes.*

Two days afterwards, the 4th of October, 1608, we find the following entry upon the Journals of the States:—

"*Sabathi*, 4 *October*, 1608.

"Resolved, that inclusive of the communication held the 2nd instant with Hans Lippershey, a native of Wesel, inventor of the instrument to see at a distance, one person from each province will be named, to examine and to try the said instrument on the turret of the mansion of his Excellency (Prince Maurice,) and to investigate whether it is likely to be of such utility as is generally believed; and, in such a case, to treat with the inventor, that he undertakes to make three such instruments of *rock-crystal*, (*christael de roche*,) for which he asks a thousand florins a-piece; that he moderates his charge, and promises never to transmit his invention to anybody."

In this piece we have the counterpart of what happened to Galileo at Venice. Here we have the members of the States-General ascending the turret on Prince Maurice's house, to examine a distant object with the newly invented spy-glass, as the Venetian senators mounted the steeple of St. Mark; and probably Lippershey was equally tired as the Italian philosopher, with showing off his instrument to persons requiring telescopes to make them see with two eyes.

The mention which, in this early stage of the invention, is made of rock or mountain crystal, appears very curious. It seems that in this beginning, the difficulty of procuring glass fit for telescopes was equally as great as it is now, and *rock* crystal was frequently resorted to in the construction of object-glasses. This appears, among others, from a passage in Hevelius, who, however, gives the preference to glass. At this present day the Parisian optician. Cauchoix, constructs telescopes of rock or mountain crystal, which he calls *lunettes vitro-crystallines*; but which, in my opinion, are

inferior to glass telescopes of equal size. One consequence may be deduced from the circumstance of rock-crystal being used in the construction of these telescopes, which is, that this spectacle-maker must have been well skilled in his profession, inasmuch as it is much more difficult to work and to select crystal than glass.

The 6th of October following, mention is made again in the Acts of the States, of the subject of telescopes:—

"*Lunæ*, 6 *October*, 1608.

"The commissioners of the Provinces who have examined the instrument made by John Lippershey, spectacle-maker, and who have communicated with him, report that the instrument is likely to be of utility to the state, and that in consequence, they offered to the inventor to make such an instrument of rock-crystal for the state, at the price of three hundred florins, payable immediately, and six hundred florins more when the instrument is completed and approved of. Resolved, to authorize these gentlemen, as is done by the present, to come to a final conclusion with Lippershey, about the making of the said instrument, and to limit him a time within which the instrument is to be completed and delivered in good order. And then the States are to deliberate whether a privilege or an annual pension is to be granted to the petitioner, under condition, that he will promise to make no such instruments, but with the consent of the States."

Whilst these transactions were taking place with Lippershey, Metiús, the second competitor, handed in his petition the 17th of October. Having gone so far with Lippershey, the States were perhaps at a loss how to dispose of Metiús's claim. They contented themselves with giving him some empty words of encouragement, and some vague promises for the future. After this time nothing more was done by Metiús to attract public notice. He doggedly refused to show his telescopes to anybody, not even to Prince Maurice, and least of all to his brother, the Professor of Franeker. Perhaps Jacob Metiús was disgusted with the little encouragement he received, and it is not unnatural to suppose, that a man of his eccentric habits, having once failed in his object, could not make up his mind to make a second attempt.

The petition of Metiús appears, however, to have had some influence on the manner in which the petition of Lippershey was disposed of.

We next find the following notes on the Record Book of the States-General:—

"*Jovis*, 11*th December*, 1608.

"The petition is read of Hans Lippershey, spectacle-maker, inventor of a certain instrument for seeing distant objects: no resolution has been taken on it, but Messrs. Van Dordt, Magnús, and Vander Aa, are appointed to speak with the petitioner about the said invention."

"*Lunæ*, 15*th December*, 1608.

"Messrs. Magnús and Vermanne report, in the absence of Messrs.

Vander Aa, and Boeles, that they examined the instrument invented by the spectacle-maker, Lippershey, to see at a distance *with two eyes,* and that they approved of it; in consequence of which it was proposed whether the privilege ought to be granted to the said Lippershey, of making alone the said instrument for a certain number of years, and to pay him the remaining six hundred florins which were promised him for the said instrument. Resolved, that whereas it appears *that many other persons have a knowledge of this new invention,* to see at a distance, it is expedient to refuse the prayer of the petitioner for an exclusive privilege, but that he will be commanded to make, within a certain time, two other instruments of his invention, for seeing with two eyes, for the same price; and checks are to be despatched to him for three hundred florins, and when the instruments are completed, of six hundred florins."

Lippershey used no delay in making the instruments, thus setting an example which the most eminent in his profession are said not to have always followed. The next mention is made of Lippershey in February, 1609.

"*Veneris, 13th February,* 1609.

"Hans Lippershey delivered the two instruments for seeing at a distance, which he was ordered to make, and in consequence it has been resolved to despatch checks of the three hundred florins remaining of the nine hundred which were promised him for three of the said instruments."

From these documents it appears that both Lippershey and Metiús failed in their attempt of obtaining an exclusive privilege. But certainly the instruments of the former were liberally paid for. Nine hundred florins, or *75l.*, for an instrument such as it can be expected to have been at that time, is certainly a high price; and even at the present time a very respectable telescope could be obtained for that money. From this circumstance we would be rather inclined to argue, that these instruments were not so roughly made as Italian authors, and those who follow them, are willing to persuade us. Our thrifty forefathers were too prudent and too economical to throw away considerable sums of the public money on things of bad manufacture and rough making.

Italian writers generally represent the Dutch telescopes as very imperfect. But how do these writers know this? Has Nelli, or any other, ever seen one of the telescopes of that time? If not, how can they judge of their performance? There is not the least necessity, in order to value the transcendent genius of a Galileo at its proper standard, to depreciate the merit of others; and we may admire Galileo without being unjust towards his contemporaries.

It is very remarkable that the absurd wish of the States to have an instrument which would enable them to see with two eyes, should have led to the invention of an instrument which has at present fallen into undeserved oblivion. It appears from the official documents, that Lippershey indeed gratified the wishes of the States, and that he produced an instrument with which they could see with two eyes. There can be little doubt but that this instrument was what was

called afterwards *a binoculus.* The invention of this instrument is generally attributed to the Capuchin friar, Rheita,* who describes it in one of the most singular books which ever were written. For terrestrial objects a well arranged binoculus is perhaps the most pleasant telescope, but some dexterity is wanted to bring it to proper adjustment. It shows the objects considerably brighter and more distinct than a common telescope of equal power; and it has the great advantage of not straining and fatiguing the eye.

The readiness with which Lippershey furnished the States with the binoculus is a proof of considerable ingenuity, and must tend to do away with the notion that he was a low, ignorant mechanic, guided by mere chance.

The States, refusing to grant the privilege which Lippershey wished to obtain, gave as a reason of their refusal that the invention was *known to many.* Of this we have evidence in Metiús's petition; but we may find some more, in a book from which one would little expect to draw scientific information.

Negotiations, which terminated in a twelve years' truce, were then pending in the Hague, between the States and Spain. The ministers of the king of France, Henry IV. were the celebrated President de Jeannin and Monsieur Bussi. The letters which Jeannin wrote on the subjects of these negotiations to the king and his ministers have been printed, and amongst them we find something relating to the history of the invention of telescopes.†

Thus on the 28th of December, 1608, a few days after the States had refused the privilege to Lippershey, Jeannin and Bussi write to the king.

"The bearer, who returns to France, is a soldier of Sedan, who served some time in Prince Maurice's company.‡ He possesses several inventions for the war, and that form of glasses [the French has *lunettes*] which have recently been invented in this country by a spectacle-maker of Middleburg, by which one sees at a great distance. The States ordered the workman, who is the inventor of them, to make two for your majesty. We should not have required their favour, if the artist had been willing to make them at our own request; but he refused, saying, that he had express orders from the States, not to make them for any body. We will send them to your majesty on the first opportunity; and notwithstanding this soldier makes them as well (*aussi-bien*) as the other, as appears by the trials which he made, still the difficulty of making them is not great."

The same day the President writes to the minister Sully:

"The bearer of this letter is a soldier from Sedan, who belongs to the prince's company, and who is held very ingenious in many inventions and artifices of the war. He has also made, a few days

* Oculus Enoch et Eliæ, sive Radius sidereo-mysticus planetarum, Antwerpiæ, 1645, fol. p. 348, 354. See also Dioptrique Oculaire par le Père Cherubin Le Gentil, Memoires de l'Academie des Sciences, 1778. Smith's Optics, p. 974.

† Lettres et Négotiations du Président de Jeannin. Paris, fol. 1656.

‡ In the Prince's guards.

ago, an engine, (*un engin,*) in imitation of that which has been made by the spectacle-maker of Middleburg, to see at a distance. He will show it to you, *and make you some for your sight.* I requested the first inventor to make me two, one for the king, and one for you; but the States prohibited him from making any but for themselves. They ordered some themselves to give them to me, that I may send them to you, which I will do the first day."

The king's reply is very remarkable, being written about a year before that prince was murdered at the instigation of the Jesuitical faction. He writes thus the 8th of January, 1609:

"I shall see with pleasure the glasses which you mention in your letter, though at present I am more in want of such that can show me things near me, than of those which show distant objects."

Having thus shown what are the respective claims of Metiüs and Lippershey, we must now consider those of a third pretender to the honour of the invention. This person was also a spectacle-maker of Middleburg, called Zacharias Tansz, and he has, more generally than Lippershey, been considered as the original inventor. The information of what we know about him must be wholly derived from Borel's book on the invention of telescopes. William Borel, who appears to have been very anxious about this matter, being himself a native of Middleburg, had all the persons then living, and knowing something on the subject, examined before the magistrates in 1655. Their depositions are given in Borel's book; but the originals of these depositions have not been found in the records of the town of Middleburg, although a very diligent search was made for them. In these documents, the places and houses in which both Lippershey and Zacharias Tansz lived, are frequently mentioned. These houses have since been taken down, and an open space now occupies the place where the telescope was invented.

Some of the witnesses, whose evidence is given in Borel's book, are in favour of Lippershey, and some in that of Zacharias. We must now carefully sift that evidence, and compare it with what Borel says on the subject, in a letter to Pierre Borel.

The first witness who occurs on the list is John Williams, a steward or beadle. He is seventy years of age, in 1655, and knew Laprey personally when he made spectacles. Afterwards he made telescopes, (*tubos longos,*) which he did about fifty years, when Laprey offered the first telescope to Prince Maurice, as he (the witness) heard at the time.

This witness brought the invention down to 1605, but he does not appear to have had a very clear recollection of the exact time of the invention.

The second witness is Edwold Kien. He is a messenger, aged sixty-seven; says that the man who made the telescopes was John Laprey, of Wesel; that he began making telescopes about 1610, and died in October, 1619. He (the witness) married the daughter of this Laprey. Laprey offered to Prince Maurice and to the States some of his telescopes, for which he got a reward, and a privilege for three years. He adds, that the sign of the house where Laprey lived was a *telescope.*

From a comparison of dates, it is obvious that this witness is mistaken, and that Lippershey made telescopes, and offered them to the States, long before 1610.

The third witness is a blacksmith of the name of Abraham Junius, aged, in 1655, seventy-seven. He says, that the name of the man who first made telescopes in this town was Hans, *i. e.* John, but that he did not observe the surname; that this man was commonly called John the spectacle-maker; that about forty-five or forty-six years ago this John made the first long telescopes; (*conspillia longa;*) that the witness knew him long ago, before he made spectacles, when he was a bricklayer; he assisted at the funeral of John; he knows, and heard very often, that John made long tubes (*tubos longos*) and telescopes for the use of Prince Maurice.

This witness brings the invention to 1609 or 1610, and very little is to be concluded from his evidence.

The Capuchin Friar, Rheita,* attributes also the first invention to Lippershey, whom he calls Lippensum. This is certainly no great alteration of the original name, not greater than that which is made by the English author of the Life of Galileo, who chooses to translate Borel's name into Italian, and calls him *Borelli.* According to the version of Rheita, the invention dates from 1609, when Lippershey happened to place a convex before a concave, and discovered, by chance, that the weathercock of a neighbouring church, and other objects, were magnified. He placed his glasses in a tube, and amused the visiters of his shop by showing them the weather-cock magnified, and larger than it could be seen with the unassisted eye. The Marquess of Spinola, happening to be at the Hague at the time, to negociate about the truce, saw this new instrument, bought it, and gave it to the ArchdukeAlbert of Austria, the Spanish Governor of Belgium.

In the mean time persons of high station (*procceres*) heard of the circumstance, and that other similar instruments had been constructed by the maker. The inventor was forced to sell his instrument for a great price; but he was prohibited from making or selling any more of them. In this manner, says the worthy friar, this noble and capital invention would have remained in obscurity, and hidden perhaps for ever, if it had not been transferred, by the will of God, to the court of Brussels, and made known there.

The Capuchin friar is mistaken in the dates, bringing the invention to 1609 instead of 1608. But besides, the Marquess of Spinola was not at the Hague in 1609. He left that city the 30th of September, 1608, together with the other Spanish ministers. That he left the Hague a little before Lippershey presented his petition to the States; but the Marquess, residing at the Hague, certainly could not see an apparatus which a spectacle-maker had erected in his shop at Middleburg; but, at all events, there is a possibility that Spinola, residing at the Hague in September, 1608, heard of the invention, and procured a telescope for the Archduke.

[TO BE CONTINUED.]

* Oculus Enoch and Eliæ, p. 337.

The nature and properties of the Sugar-Cane, with practical directions for the improvement of its culture, and the manufacture of its products.—By George Richardson Porter.

The author of the volume before us, informs us in his preface, that his attention has been particularly called to the subject of the manufacture of sugar, by the circumstance of his having obtained the grant of a patent for an invention, which he does not doubt will be eminently useful to the sugar planter, in the successful and economical manufacture of his produce; and further, that in attempting to supply the deficiency, which he has detected as arising from the want of any publication in our own language of adequate authority on the general nature of the subject, he has not relied alone on his own experience, but has availed himself of every source of knowledge to which he could obtain access.

In the first chapter, Mr. Porter endeavours to trace the origin of the sugar cane, and gives a brief sketch of its gradual progress throughout the world, to the time of its produce being considered almost a necessary of life in every civilized land. He then gives a description of the plant in its botanical character, as well as of its peculiar properties, and the manner of its secreting its juice; and proceeds to point out the influence of soil and climate in the cultivation, and the vegetable economy of the plant.

In the sixth chapter, in speaking of the expressed juice, he remarks—

The proportion and quality of the different juices vary, more or less, in the cane liquor, depending, not only on the kind of cane and the season, but also on numerous other local circumstances. The water which the liquor contains must be considered under two different relations; the one holding the mucus and mucilage in a saturated solution: this is called the water of solution, and, combined with these matters, takes the name of sirop; the second is the superabundant water, and is generally from sixty to eighty-five per cent. in quantity, over and above the water of solution.

In order to exhibit the relative proportions of water and sirop, we give the following table, taken from Dr. Dutrone's work; an authority which we have uniformly found so accurate, that we do not hesitate to take this table as a guide. It is constructed from experiments made with solutions of very pure sugar, taken at all degrees of the saccharometer. By means of the saccharometer and this table, the proportion of sugar contained in the expressed juice may be immediately ascertained, and the quantity of water which must be evaporated, to bring it to the point of saturation, can be accurately determined. It will also enable us to judge, by approximation, of the proportion of water and soluble matter contained in juices of middling and bad qualities.

Table of the quantity of Sugar contained in one hundred pounds of expressed cane juice or sirop of good quality; and also of the quantity of water that must be evaporated, to reduce the same to the state of saturated sirop, taken at each degree of the saccharometer.

Scale of Baume's Degrees	Weight of Sugar in each 100 lbs. juice or sirop.			Weight of Water in each 100 lbs. juice or sirop, beyond the water of solution.			Specific gravities of solutions at each Degree.			
	lbs.	oz.	dr.	lbs.	oz.	dr.	Deg.	Sp. gr.	Deg.	Sp. gr.
1	1	13	6	97	..	15	1	1006	35	1312
2	3	10	12	94	1	14	2	1013	36	1324
3	5	8	3	91	2	13	3	1020	37	1336
4	7	5	10	88	3	12	4	1028	38	1349
5	9	3	..	85	4	10	5	1035	39	1361
6	11	..	7	82	5	11	6	1042	40	1374
7	12	13	14	79	6	9	7	1050	41	1386
8	14	11	4	76	7	8	8	1058	42	1400
9	16	8	11	73	8	7	9	1065	43	1413
10	18	6	1	70	9	6	10	1073	44	1427
11	20	3	8	67	10	5	11	1181	45	1441
12	22	..	15	64	11	4	12	1090	46	1456
13	23	14	5	61	12	3	13	1100	47	1470
14	25	11	12	58	13	3	14	1106	48	1485
15	27	9	2	55	14	1	15	1114	49	1500
16	29	6	9	52	15	1	16	1125	50	1515
17	31	4	..	50	..	..	17	1132	55	1618
18	33	1	6	47	..	15	18	1140		
19	34	14	13	44	1	14	19	1148		
20	36	12	3	41	2	13	20	1157		
21	38	9	10	38	3	12	21	1167		
22	40	7	1	35	4	11	22	1176		
23	42	4	7	32	5	10	23	1186		
24	44	1	14	29	6	9	24	1195		
25	45	15	4	26	7	8	25	1205		
26	47	12	11	23	8	7	26	1215		
27	49	10	1	20	9	6	27	1225		
28	51	7	8	17	10	5	28	1235		
29	53	4	15	14	11	4	29	1246		
30	55	2	5	11	12	3	30	1256		
31	56	15	12	8	13	2	31	1267		
32	58	13	3	5	14	1	32	1278		
33	60	10	9	2	15	..	33	1289		
34	62	8	..				34	1301		

A saturated solution of very pure sugar contains five parts of sugar and three parts of water. This is indicated by 34° of Baume's saccharometer, at the temperature of 82° Fah.

The variation in the proportion of superabundant water is sometimes so considerable, that Dutrone found in the same plantation, at three months' interval, cane-juice, differing from 5° to 14° of the saccharometer. The first contained, according to the table, 9 lbs. 3 oz.; the second 25 lbs. 11 oz. of sugar in 100 lbs. of juice.

Cazaud found that in January, four hundred gallons of juice commonly yielded forty-eight gallons of sugar and molasses, one with the other; in February, from fifty-six to sixty-four; in March, from

sixty-four to seventy-two; and in April, sometimes eighty. He affirms, that the dryness of the season, and not the age of the canes, is the cause of this increase of produce: he considers the greatest relative maturity of the canes to be, when the juice is four parts water and one part sugar and molasses. Edwards considers the average proportion to be eight parts water and two sugar and molasses, the latter equally divided.

The juice of canes, just arrived at their full growth, is in the sweet mucous state; this, when clarified and concentrated, assumes a very deep brown colour, and becomes sirop of very thick consistency; if the heat applied be greater than 221° Fah. it will be decomposed; if the juice be expressed from the cane while maturing, the mucous juice is then in the saccharine state, and when clarified and concentrated, produces sirop of a very deep colour and thick consistence; it can scarcely support 225° Fah. without decomposition, while the mucous juice, in the state of essential salt, remains undecomposed at the heat of 260°, and pure sugar will bear exposure to 300°, and even higher, without injury.

It can now be easily perceived, how greatly the presence of sweet and saccharine juices is injurious to the manufacture of sugar, when, as is now always the case, degrees of heat are used sufficiently high to decompose them. The mucilage is more or less abundant according to the nature of the cane and the situation in which it grows; it is the colouring matter of the juice, which varies from lemon colour to a deep brown, according as the heat and alkalis, in separating this matter from the feculencies, increases the proportion of mucilage which is held in solution by the fluids. We have already said that alkalis, combining with the mucilage, give intensity to its colour in proportion to their causticity, and the smell peculiar to the cane is lost in that of leys.

Mineral and acetic acids revive the yellow colour of the juice, and change it to amber, more or less dark, according to their strength. The vegetable acids, such as cream of tartar, citric acid, &c. &c. weaken and partially destroy its colour; oxalic acid destroys it entirely, when the base of this juice, deprived of the colouring principle which held it in solution, shows it under a solid form, white and insoluble in all menstrua. It can readily be conceived that the mucilage, having for its base a substance which is only held in solution by a colouring principle, will injure the crystallization of the sugar in proportion to the quantity of that mucilage which is contained in the expressed juice; whence it may be concluded, that alkalis are injurious in proportion to their activity in separating the mucilage from the feculent parts, and that, in the necessity of employing them to clarify the expressed juice, we should carefully seek for every means of judiciously conducting the operation. This delicate and important office is, however, generally performed in the most slovenly and careless manner.

We next have a description of the general method of manufacturing the juice into sugar, as practised in our colonies, and also of the distillation of rum from the molasses and other matters usually sub-

jected to this process. From the next chapter, which describes at considerable length the French method of manufacturing sugar, as practised by Dutrone, we propose making some extracts.

In speaking of Dutrone he says—After having examined with the greatest care, and in every possible point of view, the means generally in use in his time; after having minutely and profoundly studied the nature of the cane, and acquired the most intimate knowledge of its juice, he discovered and adopted what he considered the most advantageous method for the manufacture of this juice. Many methods seem to have passed in review before him, and many appear to have been rejected before he ultimately fixed his choice. In this selection he was guided, by experience, to the adoption of plans in agreement with the soundest principles of chemistry, and appeals to the result as confirming the propriety of his choice.

In the description about to be given, every operation will be shown perfectly distinct; it will be seen, that each follows the other without confusion, or intermixture; that every step of this method, and the order of its progress, is simple, easy to be understood, and certain in its execution. It will readily be acknowledged, that this progress can be applied to all circumstances under which the juice may be found; that it does not always require the presence of the superintendent; that it may be confided to persons comparatively ignorant, without their being able to derange it, and that all the faults, which are the inevitable effect of negligence, can be repaired with smaller loss than has usually arisen from similar causes.

Dutrone was convinced of the absolute impossibility of entirely removing, by the scummer, the impurities belonging to the juice, and the extraneous earthy matters, which are always in a greater or less proportion found in it; he therefore saw that it was absolutely indispensable to filter, and to leave the cane liquor to deposit before concentrating. For this purpose he adapted two reservoirs, to communicate with the concentrating vessels, which fulfilled this end admirably well, and produced the greatest advantages.

In order that every operation which the manufacture of the juice requires, and the order which it ought to keep, may be easily seen and followed, we will explain the arrangement of the interior of a sugar-house, which Dutrone conceives best qualified for the proper application of this method. All the operations required can be accomplished, either by the assistance of one furnace or two separate ones. In the greatest number of plantations one furnace is preferable, because, while it equally well accomplishes the proposed end, it effects economy of fuel and labour. In very large plantations, where the most powerful means are required, two furnaces should be erected, but it will make no difference in the arrangement of the sugar-house. The vessels used for boiling, are called, collectively, the laboratory, which generally consists of three or four boilers placed in a line. Whatever may be the disposition of the laboratory, the order of the work is the same. The laboratory should be placed in the sugar-house, in such a manner that its two sides and the end, formed by the concentrating pan, should be isolated through

the whole extent, in order that the attendance on them may be easy, and that the negroes may be able to execute, with the greatest economy of time and of means, every thing proper to be done for the greatest perfection of the work. The laboratory, in the interior of a sugar-house, has four copper vessels, the capacity of each ought to be from 300 to 600 gallons.* The first, which receives the expressed juice, is called the first clarifier; the next, the second clarifier, the third, the evaporator, the fourth, the concentrator. These vessels are placed very near to each other, and have only an edge of two or three inches thickness between them. The masonry in which they are set forms the sides of the laboratory, the least thickness of which, at the upper part, is about fifteen or eighteen inches. The surface of this masonry is inclined seven or eight inches from the outer edge to the lip of the boilers; there are between each of these, basins let into the masonry, where the scum which is taken off is put, and this is carried back, by channels, to the first clarifier: between this vessel and the wall is a basin, which receives the first feculencies, whence they flow, through a pipe, to a vessel placed underneath to receive them. These basins and channels are made of lead, soldered to a setting of copper, which covers the surface of the masonry of the laboratory; this setting is soldered to the circumference of the boilers, which are also soldered to each other; in this state the laboratory offers the best adaptation to the desired end.

It should be remarked, that in the centre of the basins, which are between the evaporator and the concentrator, there is an opening to a canal, which descends in the thickness of the masonry, and which is then continued horizontally to the bottom of a copper vessel, placed at the foot of the reservoirs for filtration and subsidence. On the surface of the laboratory, on each side of the concentrator, there are canals which proceed from the reservoirs through the brick work, and open near the brim of the boiler. A cooler, placed at the end of the concentrator, forms also part of the laboratory. Two reservoirs, placed at a little distance from the laboratory, serve for filtration and subsidence. The filters ought to be large enough to contain all the expressed juice (diminished to the state of sirop, indicating twenty-four or twenty-six degrees of the saccharometer,) which the mill can furnish in twenty-four hours; they ought to be made of masonry, lined with lead, and entirely covered with several sieves, the bottoms of which may be made with osier hurdles. There are fixed on these bottoms, for the purpose of filtration, first a woollen, then a linen cloth, and lastly a reticulation of brass wire. Two leaden canals form a communication between the reservoirs and the labo-

* Their dimensions are—

	Depth.	Diameter. *Top.*	Diameter. *Bottom.*
a - -	27 inches.	88 inches.	64 inches.
b - -	28 "	88 "	64 "
c - -	29 "	80 "	62 "
d - -	30 "	78 "	60 "

Their bottoms are slightly convex.

ratory, the one conveys the evaporated sirop to the vessel placed at the foot of each reservoir, from whence it is poured upon the filters; the other, the opening of which, at the bottom of the reservoir, is shut by a valve, carries back the sirop, filtered and subsided, to the concentrator. The bottom of the reservoir for subsidence, ought to be raised half an inch above the level of the opening of the canal, near the brim of the concentrator. The sugar-house ought to have two laboratories, and each laboratory ought to communicate with the reservoirs.* The reservoirs for the expressed juice are common, or proper, to each laboratory; they are placed outside the sugar-house, as much for cleanliness as for preserving the juice cool; they ought to be covered by a well inclosed shed, or vaulted over. These reservoirs, lined with lead, should each be large enough to contain three hundred and seventy-five gallons, at the least; they ought to be always filled to a fixed and determinate height, equal to one charge,† in order that not only an exact account may be kept of the quantity of expressed juice which comes to the sugar-house, but also of the quantity of lime that should be employed to separate the feculencies from the juice. As it is highly proper to know the degree of richness of the juice to be manufactured, there should be a saccharometer to ascertain it from time to time.

[TO BE CONTINUED.]

The Results of Machinery, namely, Cheap Production and Increased Employment Exhibited; being an Address to the Working Men of the United Kingdom. Forming No. 1 *of the Working Man's Companion.*

This is a work just published by the Society for the Diffusion of Useful Knowledge. We can imagine nothing more suitable to the general mass of readers, and are quite sure that nothing could have been better timed. It is the very thing that was wanted to dispel that great popular delusion which has made the events of the year 1830 an absolute disgrace to us as a civilized and manufacturing people. It is the strong right arm of reason put forth in aid of the comparatively weak arm of the law. In manner and matter it is alike admirable; the style simple and familiar—the reasoning clear—the illustrations copious and well chosen—and the treatment of the subject altogether so satisfactory, that not a shadow of doubt can rest on any willing mind of the soundness of the general conclusion which it is the great purpose of the book to enforce; namely, that to oppose machinery, is to oppose the very best friend the poor, as well as rich, ever had.

* It is always better to have two fire places, though only one should be used at a time, lest any accident should happen to the one in use. This precaution is more necessary, since, as the canes cannot be kept without fermenting, all those which were cut would be lost.

† The charge must be a determinate quantity, which ought never to vary when once fixed.

The writer enters on his subject in a manner singularly well calculated to arrest the attention of those classes to whom it is more particularly addressed.

"In the year 1827, a Committee of the House of Commons was appointed to examine into the subject of emigration—that is, to see whether it was desirable and practicable to remove distressed labourers from the United Kingdom to distant places, where their labour might be employed profitably to themselves and others. The first person examined before that committee was Joseph Foster, a working weaver of Glasgow. He told the committee, that he and many others, who had formed themselves into a society, were in great distress; that numbers of them worked at the hand-loom from eighteen to nineteen hours a-day, and that their earnings at the utmost did not amount to more than seven shillings a week, and that sometimes they were as low as four shillings. That twenty years before that time they could readily earn a pound a-week by the same industry; and that as power-loom weaving had increased, the distress of the hand weavers also had increased in the same proportion. A power-loom is one worked by machinery, and not by the hand of man, as most of our readers, perhaps, know. The committee then put to Joseph Foster the following questions, and received the following answers:—

"Q. 'Are the committee to understand that you attribute the insufficiency of your remuneration for your labour to the introduction of machinery?'

"A. 'Yes.'

"Q. 'Do you consider, therefore, that the introduction of machinery is objectionable?'

"A. 'We do not. The weavers in general, of Glasgow and its vicinity, do not consider that machinery can or ought to be stopped, or put down. They know perfectly well that machinery must go on, that it will go on, and that it is impossible to stop it. They are aware that every implement of agriculture or manufacture is a portion of machinery, and, indeed, every thing that goes beyond the teeth and nails, (if I may use the expression,) is a machine. I am authorized, by the majority of our society, to say, that I speak their minds, as well as my own, in stating this.'

"If all, or if a large majority of the working men of our country had come to the same sound opinions as Joseph Foster, we should not take the trouble, because it would be needless, now to address them. But when we hear on all sides that misguided men are violating the laws by which the rights of all are protected; that they are wickedly and ignorantly destroying the property of the farmer and the manufacturer, in the belief that machinery *can* be stopped or put down; that they do *not* know, as the poor weavers of Glasgow *did* know, that machinery must go on, will go on, and that it is impossible to stop it; we think it our duty, having the means of appealing to their reason and to their regard for their own interests, to endeavour to bring their minds to the same conclusions as those of the respectable weaver, whose words we have repeated. He felt that, although he was in his own person a sufferer from the improvement

of machinery, it was utterly out of his power, because it was contrary to his reason, and to the reason of all thinking people, whether working men or not, to resist the progress of that improvement. There are many working men who entertain the same sound opinions, which they have come to, probably, by an accurate and dispassionate observation of the facts which are within their own view. To such men we hope to offer many new facts to strengthen their opinions; and we rely greatly upon their influence to point out their errors either to those who are violating the laws, or to those who think the violators of the laws have justice on their side. For the benefit of you all, the informed as well as the uninformed, we address you as men capable of reasoning. We give you a great body of facts to reason upon. We offer nothing to your passions or your prejudices. We shall attempt to make you feel, by bringing before you the same sort of facts by which that sensible man, Joseph Foster, convinced his own mind, that although your individual labour may be partially displaced, or unsettled, for a time, by the use of a cheaper and a better power, which power is machinery, you are great gainers by the general use of that power. We shall strive to show you, that through this power you possess, however poor you may be, many of the comforts which make the difference between man in a civilized and man in a savage state; and further, that, in consequence of machinery having rendered productions of all sorts cheaper, and therefore caused them to be more universally purchased, it has really increased the demand for that manual labour, which it appears to some of you, reasoning only from a few instances, it has a tendency to diminish. If we make out these propositions, we think you will agree with Joseph Foster, that the introduction of machinery is not objectionable."

But, first of all, what is this *machinery* against which such an outcry is raised? There are persons who affect to make a distinction between tools and machines; but the writer shows, with great force and clearness, that the principle of both is precisely the same.

"A tool of the simplest construction is a machine; a machine of the most curious construction is only a complicated tool. There are many cases in the arts, and there may be cases in agriculture, in which the human arm and hand, with or without a tool, may do work that no machine can so well perform. There are processes in polishing, and there is a process in copper-plate printing, in which no substance has been found to stand in the place of the human hand. And if, therefore, the man with a spade alone, does a certain agricultural work more completely than a man guiding a plough, and a team of horses dragging it, (which we do not affirm or deny,) the only reason for this is, that the man with the spade is a better machine than the man with the plough and the horses. The most stupid man that ever existed is, beyond all comparison, a machine more cunningly made by the hands of his Creator, more perfect in all his several parts, and with all his parts more exquisitely adapted to the regulated movement of the whole body, less liable to accidents, and less injured by wear and tear, than the most beautiful machine that

ever was, or ever will be, invented. There is no possibility of supplying, in many cases, a substitute for the simplest movements of man's body, by the most complicated movements of the most ingenious machinery. And why so? Because the natural machinery by which a man even lifts his hand to his head is at once so complex and so simple, so apparently easy, and yet so entirely dependant upon the right adjustment of a great many contrary forces, that no automaton, or machine imitating the actions of man, could ever be made to effect this seemingly simple motion, without showing that the contrivance was imperfect—that it was a mere imitation, and a very clumsy one. What an easy thing it appears to be for a farming man to thrash his corn with a flail; and yet what an expensive arrangement of wheels is necessary to produce the same effects with a thrashing machine. The truth is, that the man's arm and the flail form a much more curious machine than the other machine of wheels, which does the same work; and the real question, as regards the value of the two machines, is, which machine in the greater degree lessens the cost of production?

"We state this principle broadly, in our examination into the value of machinery in diminishing the cost of producing human food. A machine is not perfect because it is made of wheels or cylinders, employs the power of the screw or the lever, is driven by wind, or water, or steam, but because it best assists the labour of man, by calling into action some power which he does not possess in himself. If we could imagine a man entirely dispossessed of this power, we should see the feeblest of animal beings. He has no tools which are a part of himself, to build houses like the beaver, or cells like the bee. He has not even learnt from nature to build, instinctively, by certain and unchangeable rules. His power is in his mind; and that mind teaches him to subject all the physical world to his dominion, by availing himself of the forces which nature has spread around him. To act upon material objects, he arms his weakness with tools and with machines. As we have before said, tools and machines are, in principle, the same. When we strike a nail upon the head with a hammer, we avail ourselves of a power which we find in nature—the effect produced by the concussion of two bodies; when we employ a water wheel to beat out a lump of iron with a much larger hammer, we still avail ourselves of the same power. There is no difference in the nature of the instruments, although we call the one a tool, and the other a machine. Neither the tool nor the machine have any force of themselves. In one case the force is in the arm, in the other in the weight of water which turns the wheel."

It is next shown that even tools of the very simplest description are not to be obtained without the aid of machinery.

"All labourers in agriculture know, full well, the value of a tool; but some hate machinery. This is inconsistent. Unless the labourer made a plough, (if he will consent even to a plough,) out of two pieces of stick, and carried it upon his shoulder to the field, as the toil-worn and poor people of India do, he must have some *iron* about

it. He cannot get iron *without machinery.* But he hates machinery, and therefore he will have nothing to do with a plough! Will he have his hoe, then? He is not quite sure. Will he give up his knife? No; he must keep his knife. He has got every thing to do for himself, and his knife is his tool of all-work.

"Well, how does he get this same knife? People that have no machinery sharpen a stone, or bit of shell, or bone, and cut or saw with it in the best way they can; and after they have become very clever, they fasten it to a wooden handle with a cord of bark. An Englishman examines two or three dozens of knives, selects which he thinks the best, and pays a shilling for it, the seller thanking him for his custom. The man who has nothing but the bone or the shell would gladly toil a month for that which does not cost an English labourer half a day's wages.

"And how does the Englishman obtain his knife upon such easy terms? From the very same cause that he obtains all his other accommodations cheaper, in comparison with the ordinary wages of labour, than the inhabitant of any other country—that is, from the use of machinery, either in the making of the thing itself, or in procuring that without which it could not be made.

* * * * * *

"Ready made, without the labour of some other man, a knife does not exist; but the iron of which the knife is made, is to be had. Very little iron has ever been found in a native state, or fit for the blacksmith. The little that has been found in that state has been found only very lately; and if human art had not been able to procure any in addition to that, gold would have been cheap as compared with iron.

"Iron is, no doubt, very abundant in nature; but it is always mixed with some other substance that not only renders it unfit for use, but hides its qualities. It is found in the state of what is called iron ore, a stone or earth of some kind or other. Sometimes it is mixed with clay, at other times with lime or flint; and there are cases in which it is so much mixed with sulphur, that it burns like a piece of coal if put in the fire. In short, in the state in which iron is met with, it is a much more likely substance for paving a road, or building a wall, or making mortar, than for making a knife.

"But suppose that the man knows the particular ore or stone that contains the iron, how is he to get it out? Mere force will not do; for the iron and the clay, or other substance, are so nicely mixed, that though the ore were ground to the finest powder, the grinder is no nearer the iron than when he had a lump of a ton weight.

"A man who has a block of wood has a wooden bowl in the heart of it; and he can get it out too by labour. The knife will do it for him in time; and if he take it to the turner, the turner with his machinery, his lathe, and his gouge, will work it out for him in half an hour. The man who has a lump of iron ore has just as certainly a knife in the heart of it; but no mere labour can work it out. Shape it as you may, it is not a knife, or steel, or even iron—it is iron ore;

and dress it as you will, it would not cut better than a brick-bat—certainly not so well as the shell or bone of the savage.

"There must be knowledge before any thing can be done in this case. We must know what is mixed with the iron, and how to separate it. We cannot do it by mere labour, as we can chip away the wood and get out the bowl; and therefore we have recourse to fire."

After describing in an equally popular and instructive style the processes of making cast-iron, bar, or malleable iron, and steel, the author thus sums up the general result.

"Bringing it, (the ore,) into this state, requires great force; and the unaided strength of all the men in Britain could not make all the iron which is at present made, though they did nothing else. Machinery is therefore resorted to; and water-wheels, steam engines, and all sorts of powers are set to work in moving hammers, turning rollers, and drawing rods and wires through holes, till every workman can have the particular form which he wants. If it were not for the machinery that is employed in the manufacture, no man could obtain a spade for less than a year's labour; the yokes of a horse would cost more than the horse himself; and the farmer would have to return to wooden ploughshares, and hoes made of sticks with wooden ends."

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"As iron is with us almost as plentiful as stone, we do not think much about it. But there is a great deal to be done, much thinking and inventing, before so simple a thing as a sixpenny knife could be procured: and without the thinking and the inventing all the strength of all the men that ever lived never could procure it; and without the machinery to lighten the labour, no ingenuity could furnish it at a thousand times the expense."

Another very striking illustration of the influence of machinery in diminishing the cost of production and improving the general condition of men, is drawn from the history of the processes for grinding corn. After mentioning an instance of a New Zealander, who, on returning from a visit to England, carried home with him "a small hand-mill for grinding corn, which he prized as the greatest of all earthly possessions," the writer proceeds:—

"And well might he prize it! He had no machine for converting corn into meal but two stones, such as were used in the remote parts of the Highlands of Scotland some years ago. And to beat the grain into meal by these two stones, (a machine, remember, however imperfect,) would occupy the labour of one-fourth of his family, to procure subsistence for the other three-fourths. The ancient Greeks, three thousand years ago, had improved upon the machinery of the hand-stones, for they had hand-mills. But Homer, the old Greek poet, describes the unhappy condition of the slave who was always employed in using this mill. The groans of the slave were unheeded by those who consumed the produce of his labour; and such was the necessity for meal, that the women were compelled to turn these mills when there were not slaves enough taken in war to perform

this irksome office. There was plenty of labour then to be performed, even with the machinery of the hand-mill; but the slaves and the women did not consider that labour was a good in itself, and therefore they bitterly groaned under it. By and bye, the understanding of men found out that water and wind would do the same work that the slaves and the women had done; and that a large quantity of labour was at liberty to be employed for other purposes. You perhaps think that society was in a worse state in consequence. We will tell you exactly in what respects society gains, and what you gain as part of society, by the abolition of hand mills, and the use of wind-mills and water-mills for grinding corn.

"Labour is worth nothing without results. Its value is only to be measured by what it produces. If in a country where hand-mills could be had, the people were to go on beating grain between two stones, you would pronounce them fools, because they could obtain an equal quantity of meal with a much less expenditure of labour. You have perhaps a general prejudice against that sort of machinery which does its work with very little human assistance; it is not quite so certain, therefore, that you would agree that a people would be equal fools to use the hand-mill when they could employ the wind-mill or the water-mill. But we believe you would think, that if flour could drop from heaven, or be had like water by whoever chose to seek it, it would be the height of folly to have stones, or hand-mills, or water-mills, or wind-mills, or any machine whatever for manufacturing flour. Do you ever think of *manufacturing* water? The cost of water is only the cost of the labour which brings it to the place in which it is consumed. Yet this admission overturns all your objections against machinery. *You admit that it is desirable to obtain a thing with no labour at all; can you therefore doubt that it is desirable to obtain it with the least possible labour?* The only difference between no labour and a little labour, is the difference of the cost of production. And the only difference between little labour and much labour is precisely the same. In procuring any thing that administers to his necessities, man makes an exchange of his labour for the thing produced, and the less he gives of his labour, the better of course is his bargain.

"To return to the hand-mill and the water-mill. An ordinary water-mill for grinding corn will grind about thirty-six sacks a-day. To do the same work with a hand-mill would require 150 men. At 2*s.* a-day, the wages of these men would amount to 15*l.* which, reckoning 6 working days, is 90*l.* a week, or 4680*l.* a year. The rent and taxes of a mill would be 150*l.* a year, or ten shillings a working day. The cost of machinery would be certainly more for the hand-mills than the water-mill, therefore we will not take the cost of machinery into the calculation. To produce, therefore, thirty-six sacks of flour by hand, we should pay 15*l*; by the water-mill we should pay ten shillings; that is, we should pay thirty times as much by the one process as by the other, The actual saving is something about one-half of the price of the flour in the market; that is, the consumer, if the corn were ground by hand, would pay double what he pays now

that it is ground at a mill. He pays 10*d.* for his quartern loaf now; he would pay 20*d.* then.

"But if the system of grinding corn by hand were a very recent system of society, and the introduction of so great a benefit as the water-mill had all at once displaced the hand-grinders, as the spinning machinery displaced the spinning-wheel, what must become, you say, of the one hundred and fifty men who earned the 15*l.* a-day, of which sum, the consumer has now got 14*l.* 10*s.* in his pocket? They must go to other work. And what is to set them to that work? The same 14*l.* 10*s.* which, being saved in the price of flour, gives the poor man, as well as the rich man, more animal food and fuel; a greater quantity of clothes, and of a better quality; better furniture, and more of it; and, above all, more books. To produce these things there must be more labourers employed than before. The quantity of labour is, therefore, not diminished, while its productiveness is much increased. It is as if every man among us had become suddenly much stronger and more industrious. The machines labour for us, and are yet satisfied without either food or clothing. They increase all our comforts, and they consume none themselves. The hand-mills are not grinding, it is true; but the ships are sailing that bring us foreign produce; the looms are moving that give us more clothes; the potter, and glass-maker, and joiner, are each employed to add to our household goods; we are each of us elevated in the scale of society; and all these things happen because machinery has diminished the cost of production."

(TO BE CONTINUED.)

Preliminary Discourse on the Study of Natural Philosophy. By JOHN FREDERICK WILLIAM HERSCHEL, *Esq. A. M. late Fellow of St. John's College, Cambridge, &c.*

THIS work is calculated to be of great and extensive utility. In an age like the present, in which the means of acquiring knowledge are no longer out of the reach even of the humblest classes of society, it becomes of the utmost importance that the numberless inquiries after the truths of nature should be directed in the right path to the acquisition of the knowledge they desire; and that those who have hitherto neglected the study, from a notion of its dryness or unprofitableness, should be aroused to it by proofs of its amusing and highly useful character. To effect these too objects seems to us to be the principal aim of the author.

The discourse commences most judiciously. General readers are apt to be deterred from the perusal of a book of this nature, from an idea that the subject is necessarily a dull, and, to the uninitiated, an uninteresting one. Aware of this, Mr. Herschel strives, and strives effectually, to invest the introductory portion of his work with as much of popular interest as possible; and, by means of the introduction of numerous apposite illustrations, and of anecdotes, to render it as amusing as any tale, while the reader is unconsciously

led on to the portals of scientific inquiry. In this part, too, he takes occasion to refute the common-place objection, that science is of no practical utility. Mr. Herschel exposes its fallacy in the most simple and convincing way, by producing unanswerable instances of the wonderful effects which have been, and are daily, produced by a proper application of the laws of nature, and by showing, that without the knowledge of those laws, man is deprived of the most effectual means of raising himself above the level of the rest of the animal creation. The following extract will show how triumphantly he proves the importance of this knowledge, and, at the same time, will exemplify the remarks we have made above as to the entertaining style of this part of the work; the paragraphs, it will be noticed, are numbered—a very great help to facility of reference.

"35. But if the laws of nature, on the one hand, are invincible opponents, on the other they are irresistible auxiliaries, and it will not be amiss if we regard them in each of these characters, and consider the great importance of a knowledge of them to mankind.

"I. In showing us how to avoid attempting impossibilities.

"II. In securing us from important mistakes in attempting what is in itself possible, by means either inadequate or actually opposed to the end in view.

"III. In enabling us to accomplish our ends in the easiest, shortest, most economical, and most effectual manner.

"IV. In inducing us to attempt, and enabling us to accomplish, objects which but for such knowledge we should never have thought of undertaking.

"We shall, therefore, proceed to illustrate by examples the effect of physical knowledge under each of these heads.

"36. Ex. 1. (35.) I. It is not many years since an attempt was made to establish a colliery at Bexhill, in Sussex. The appearance of thin seams and sheets of fossil-wood and wood-coal, with some other indications similar to what occur in the neighbourhood of the great coal beds in the north of England, having led to the sinking of a shaft and the erection of machinery, on a scale of vast expense, not less that £80,000 are said to have been laid out on this project, which, it is almost needless to add, proved completely abortive, as every geologist would have at once declared it must, the whole assemblage of geological facts being adverse to the existence of a regular coal-bed *in* the Hastings *sand;* while this, on which Bexhill is situated, is separated from the *coal strata* by a series of interposed beds of such enormous thickness as to render all idea of penetrating *through* them absurd. The history of mining operations is full of similar cases, where a very moderate acquaintance with the usual *order of nature*, to say nothing of theoretical views, would have saved many a sanguine adventurer from utter ruin.

"37. Ex. 2. (35.) II. The smelting of iron requires the application of the most violent heat that can be raised, and is commonly performed in tall furnaces, urged by great iron bellows driven by steam engines. Instead of employing this power to force *air* into the furnace, through the intervention of bellows, it was on one occa-

sion attempted to employ the steam itself in apparently a much less circuitous manner, viz. by directing the current of steam in a violent blast from the boiler at once into the fire. From one of the known ingredients of steam being a highly inflammable body, and the other that essential part of the air which supports combustion, it was imagined that this would have the effect of increasing the fire to tenfold fury, whereas it simply *blew it out:* a result which a slight consideration of the laws of chemical combination, and the state in which the ingredient elements exist in steam, would have enabled any one to predict without a trial."—p. 44.

Well would it have been for many an ingenious projector if he had paused in the prosecution of a favourite scheme, until he had inquired whether its success might not be incompatible with the unalterable laws which regulate the economy of the universe. Many unfortunate instances have not been wanting in which suicide has been the termination of a career of attempted discovery, a result which might have been avoided, in most cases, by merely a slight devotion to the study of natural philosophy. The melancholy end of a schemer of this description, who perished, (unintentionally,) by his own act, and in the very moment of anticipated triumph, is thus related in the volume before us:—

"38. Ex. 3. (35.) II. After the invention of the diving-bell, and its success in subaqueous processes, it was considered highly desirable to devise some means of remaining for any length of time under water, and rising at pleasure without assistance, so as either to examine at leisure the bottom, or perform at ease any work that might be required. Some years ago an ingenious individual proposed a project by which this end was to be accomplished. It consisted in sinking the hull of a ship made quite water-tight, with the decks and sides strongly supported by shores, and the only entry secured by a stout trap-door in such a manner that by disengaging from within the weights required to support it, it might rise of itself to the surface. To render the trial more satisfactory, and the result more striking, the projector himself made the first essay. It was agreed that he should sink in twenty fathoms water, and rise again without assistance at the expiration of 24 hours. Accordingly, making all secure, fastening down his trap-door, and provided with all necessaries as well as with the means of making signals to indicate his situation, this unhappy victim of his own ingenuity entered and was sunk. No signal was made, and the time appointed elapsed. An immense concourse of people had assembled to witness his rising, but in vain, for the vessel was never seen more. The pressure of water at so great a depth had, no doubt, been completely under estimated, and the sides of the vessel being at once crushed in, the unfortunate projector perished before he could even make the signal concerted to indicate his distress."

These examples might be enough to prove his proposition, but our author with a lavish hand, makes his position doubly strong by a few more modern instances. We have already quoted rather largely

from them, but we cannot resist the temptation of giving the following, it is so completely and directly to the point:—

"39. Ex. 4. (35.) III. In the granite quarries near Seringapatam the most enormous blocks are separated from the solid rock by the following neat and simple process:—The workman having found a portion of the rock sufficiently extensive and situated near the edge of the part already quarried, lays bare the upper surface and marks on it a line in the direction of the intended separation, along which a groove is cut with a chisel about a couple of inches in depth. Above this groove a narrow line of fire is then kindled, and maintained till the rock below is thoroughly heated, immediately on which a line of men and women, each provided with a pot full of cold water, suddenly sweep off the ashes, and pour the water into the heated groove, when the rock at once splits with a clean fracture. Square blocks of 6 feet in the side and upwards of 80 feet in length,* are sometimes detached by this method, or by another equally simple and efficacious, but not easily explained without entering into particulars of mineralogical detail."

Mr. Herschel winds up this branch of the subject with the following just observation:—

"41. Ex. 6. (35.) III. To accomplish our ends quickly is often of at least as much importance as to accomplish them with little labour and expense. There are innumerable processes which, if left to themselves, *i. e.* to the ordinary operation of natural causes, are done, and well done, but with extreme slowness; and in such cases it is often of the highest practical importance to accelerate them. The bleaching of linen, for instance, performed in the natural way by exposure to the sun, rain, and wind, requires many weeks or even months for its completion; whereas by the simple immersion of the cloth in a liquid, chemically prepared, the same effect is produced in a few hours. The whole circle of the arts, indeed, is nothing but one continued comment upon this head of our subject. The instances above given are selected, not on account of their superior importance, but for the simplicity and *directness* of application of the principles on which they depend, to the objects intended to be attained."—p. 49.

One class of objectors thus satisfactorily disposed of, Mr. Herschel shortly after takes occasion, incidentally, to combat the opinions of another—those who admit the benefit of scientific knowledge, but, at the same time, contend that it should not be extended to the many. Mr. Herschel is, as we have observed, one of the most brilliant living luminaries of the world of science—he has been acknowledged worthy of becoming the head of one of our most learned, and perhaps, at the same time, one of our most aristocratic societies. His opinion, therefore, on the subject of the expediency of preserving a monopoly of knowledge, cannot be uninteresting:—

"63. Knowledge can neither be adequately cultivated nor adequately enjoyed by a few; and, although the conditions of our exist-

* Such a block would weigh between 4 and 500,000 lbs.

ence on earth may be such as to preclude an abundant supply of the physical necessities of all who may be born, there is no such law of nature in force against that of our moral and intellectual wants. Knowledge is not, like food, destroyed by use, but rather augmented and perfected. * * * * Those who admire knowledge for its own sake, ought to wish to see its elements made accessible to all, were it only that they may be the more thoroughly examined into, and more effectually developed in their consequences, and receive that ductility and plastic quality which the pressure of minds of all descriptions, constantly moulding them to their purposes, can alone bestow.—"p. 69.

What can be more conclusive than this? What greater triumph for the advocates of the diffusion of scientific knowledge among the humbler classes of the people, for the promoters of those institutions whose establishment may not unlikely create a new era in the history of arts and sciences? The question of their utility, (if question it ever was,) is now settled—for Mr. Herschel's arguments cannot be easily invalidated.

Perhaps we have lingered too long on the first division of this Preliminary Discourse—if so, the fascinating nature of its contents must plead our excuse. To be more methodical, our author divides his subject into three parts.

"Part I.—Of the general nature and advantages of the study of the physical sciences."

"Part II.—Of the principles on which physical science relies for its successful prosecution, and the rules by which a systematic examination of nature should be conducted."

"Part III. Of the subdivision of physics into distinct branches and their mutual relations."

"Of the first division we have already given some account; besides, however, developing the importance of physical science, combatting the objections of the opponents to its diffusion, and inciting the undetermined or the indifferent to its study, it contains a masterly sketch of the various motive-forces in nature, at the conclusion of which the enlightened author pays the following gratifying tribute to the importance of practical mechanics.

"58. Such are the forces which nature lends us for the accomplishment of our purposes, and which it is the province of practical mechanics to teach us to combine and apply in the most advantageous manner; without which the mere command of power would amount to nothing. Practical mechanics is, in the most pre-eminent sense, a *scientific art;* and it may be truly asserted, that almost all the great combinations of modern mechanism, and many of its refinements and nicer improvements, are creations of pure intellect, grounding its exertions upon a moderate number of very elementary propositions in theoretical mechanics and geometry. On this head we might dwell long, and find ample matter, both for reflection and wonder, but it would require not volumes merely, but libraries, to enumerate and describe the prodigies of ingenuity which have been

lavished on every thing connected with machinery and engineering."
—p. 63.

Part II. consists chiefly of a demonstration of the advantages of the inductive system in the pursuit of philosophical truth, with illustrations of its wonderful success in many instances in leading to the discovery of the secrets of nature, and examples of the method of applying the process. The following rules for the observation of natural phenomena may give an idea of the clearness and conciseness of this part.

"145. When we would lay down general rules for guiding and facilitating our search among a great mass of assembled facts, for their common cause, we must have regard to the characters of that relation which we intend by cause and effect. Now these are,

"1st. Invariable connexion, and, in particular, invariable antecedence of the cause and consequence of the effect, unless prevented by some counteracting cause. But it must be observed, that in a great number of natural phenomena, the effect is produced gradually, while the cause goes on increasing in intensity, so that the antecedence of the one, and the consequence of the other, becomes difficult to trace, though it really exists. On the other hand, the effect often follows the cause so instantaneously, that the interval cannot be perceived. In consequence of this, it is sometimes difficult to decide of two phenomena constantly accompanying one another, which is the cause or which the effect."

"2nd. Invariable negation of the effect with absence of the cause, unless some other cause be capable of producing the same effect."

"3d. Increase or diminution of the effect, with the increased or diminished intensity of the cause, in cases which admit of increase and diminution."

"4. Proportionality of the effect to its cause in all cases of *direct unimpeded* action."

"5th. Reversal of the effect with that of the cause."

In the course of illustrating these and other rules, Mr. Herschel again displays his talent for agreeable and pertinent anecdote; for instance, in cautioning against the prejudices of the senses—fatal obstacles in the pursuit of truth—he proceeds thus:—

"72. To give one or two more examples of the kind of illusion which the senses practise on us, or rather, which we practise on ourselves, by a misinterpretation of their evidence; the moon at its rising and sitting appears much larger than when high up in the sky. This is, however, a mere erroneous judgment; for when we come to measure its diameter, so far from finding our conclusion borne out by fact, we actually find it to measure materially less. Here is eye-sight opposed to eye-sight, with the advantage of deliberate measurement. In ventriloquism we have the hearing at variance with all the other senses, and especially with the sight, which is sometimes contradicted by it in a very extraordinary and surprising manner, as when the voice is made to seem to issue from an inanimate and motionless object. If we plunge our hands, one into ice-cold water, and the other into water as hot as it can be borne, and, after letting them stay in awhile, suddenly transfer them to a vessel full of water at a

blood-heat, the one will feel a sensation of heat, the other of cold. And if we cross the two first fingers of one hand, and place a pea in the fork between them, moving and rolling it about on a table, we shall, (especially if we close our eyes,) be fully persuaded we have two peas. If the nose be held while we are eating cinnamon, we shall perceive no difference between its flavour and that of a deal shaving."—p. 82.

Here felicity of illustration is perhaps carried to its utmost extent, and one beauty of the instances, or most of them, is, that they are so simple, as to admit of being put in practice by any one with hardly any preparation.

In the third part, each science is considered separately; its characteristics are given, with a brief outline of its history. Of these, the most space is devoted to astronomy, chemistry, and electricity, on the wonders of the latter of which sciences, our author seems to dwell with the greatest satisfaction. The information he gives on each subject is very extensive, when the size of the book is taken into consideration; and, at the same time that it is, in one sense, satisfactory, it leaves the reader still so unsatisfied as to desire further information, and, consequently, to go further than this Preliminary Discourse can be expected to carry him—an effect which the writers of elementary works should always endeavour to produce, although few can expect to succeed in the same degree as Mr. Herschel.

Throughout the work, the astonishing progress made in every department of physical science, within the last few years, is so strikingly displayed, that the author is very appropriately led to conclude with a sketch of the causes which have led to this advance. One of the most important of these is thus noticed:—

"284. The telescope, as it exists at present, with the improvements in its structure and execution which modern artists have effected, must assuredly be ranked amongst the highest and most refined productions of human art; that in which man has been able to approximate more closely to the workmanship of nature, and which has conferred upon him, if not another sense, at least an exaltation of one already possessed by him that merits almost to be regarded as a new one. Nor does it appear yet to have reached its ultimate perfection; to which, indeed, it is difficult to assign any bounds, when we take into consideration the wonderful progress which workmanship of every kind is making, and the delicacy, far superior to that of former times, with which materials may now be wrought, as well as the ingenious inventions and combinations which every year is bringing forth for accomplishing the same ends by means hitherto unattempted."—p. 256.

It is pleasing to see a man of learning thus liberally acknowledging the obligations of philosophy to the mechanical arts. It is certain that without them astronomy could not possibly have taken the rapid strides it has made within the last half century.

We conclude by heartily recommending the work under review to our readers; we shall be surprised if by its means many, who are now insensible to the charms of philosophic research, shall not join the ranks of science; if many, whose names are destined to become

enrolled in the lists of fame as diligent observers of the natural world, or furtherers of the discovery of physical truth, shall not date their resolution of attempting to penetrate the mysteries of nature from their perusal of Herschel's Preliminary Discourse on the Study of Natural Philosophy. [*Mechanics' Magazine.*

On the Mode of Ascertaining the Commercial Value of Ores of Manganese. By Edward Turner, *M.D., F.R.S.L. and E., Sec. G.S. Professor of Chemistry in the University of London.*

The analysis of the ores of manganese, when pure, is exceedingly simple. The operator need only, by well known methods, determine the water which the ore contains, and the oxygen which it loses in being converted into the red oxide. Its degree of oxidation, on which the commercial value of ores of manganese so essentially depends, may then be readily inferred.

But when impurities prevail, as they almost always do, more or less in commercial manganese, the analytic process is complex and troublesome; and the presence of iron, which is rarely absent, renders an exact result by the ordinary modes of analysis almost impracticable. For, as I have elsewhere stated,* when peroxide of iron is strongly heated in mixture with peroxide or deutoxide of manganese, oxygen is given out by the former as well as by the latter; and, accordingly, the oxygen lost by heat ceases to indicate the nature of the manganese. A moderately correct allowance for the quantity of oxygen emitted by the iron under these circumstances would be difficult, even after ascertaining in the moist way the quantity of iron contained in the ore; since the constitution of the resulting oxide of iron, as well as its uniformity, is probably variable, and, at all events, is undetermined. The chemist would, therefore, have to ascertain separately each constituent of the ore, and consider the loss as oxygen belonging to the manganese,—a method not to be trusted in a complicated analysis, and which would be wholly inapplicable if the iron, as contained in the ore, should happen not to be uniformly oxidized.

I was led to reflect on these difficulties in consequence of being requested, some months ago, to examine a considerable number of different ores of manganese, the object being solely to ascertain the relative quantities of chlorine which an equal weight of each ore was capable of supplying; and as the method to which I had recourse gives such information with rapidity and precision, I have drawn up a short description of the process; not from any novelty being attached to it, but in the belief that it may be useful to persons engaged in a similar inquiry.

The method, in principle, consists in dissolving a given weight of the ore in muriatic acid, condensing the chlorine in water, and, by some uniform measure, estimating the quantity of chlorine relatively to an equal weight of pure peroxide of manganese, selected as a

* Brewster's Journal of Science, N. S. ii. 213.

standard of comparison. The substance first used with this intention was a solution of indigo; but a weak solution of green vitriol, employed by Mr. Dalton for ascertaining the strength of bleaching powder, was found to be more precise in its indications.

The method of manipulating is as follows:—About ten grains of the ore in fine powder is introduced into a flask capable of containing about an ounce of water, and into its neck is fitted, by grinding, a bent tube about two inches long, which conducts the chlorine from the flask into a tube about sixteen inches in length, and five-eighths of an inch wide, full of water, and inverted in a small evaporating capsule, employed as a pneumatic trough. The apparatus being adjusted, the flask is half filled with concentrated muriatic acid, the conducting tube instantly inserted, and heat applied by means of a spirit-lamp. The air of the flask, together with the chlorine, is then collected, the greater part of the latter, if the gas is not very rapidly disengaged, being absorbed in its passage; and, consequently, the receiving tube, at the close of the process, will be about half full of gas. When the ore is completely dissolved, the last traces of the chlorine are expelled from the flask by muriatic acid gas. In order that the chlorine thus collected may be entirely absorbed, the aperture is closed by a ground stopper, or, still more conveniently, with the finger, and the gas is well agitated until the chlorine is wholly absorbed. As the solution in the inverted tube may become too much saturated to dissolve all the chlorine, it is convenient to fill a pipette with pure water, and, with the aid of the mouth, force a current to ascend into the tube, and thereby cause the heavier solution to flow out into the capsule.

The absorption being complete, the solution of chlorine is introduced into a six or eight ounce stoppered bottle, and a dilute solution of green vitriol, made, for example, with a hundred grains of the crystallized salt and a pint of water, is added in successive small quantities until the odour of chlorine just ceases to be perceptible. The quantity of liquid required for the purpose may be conveniently measured in a tube about sixteen inches long, and three-quarters of an inch in diameter, divided into two hundred parts of equal capacity, and supplied with a lip, so that a liquid may be poured from it, without being spilled. In conducting this part of the process, the operator will perceive two odours:—at first, the characteristic odour of chlorine, accompanied with the peculiar irritation of that gas;—and, subsequently, an agreeable, somewhat aromatic odour, unattended with the slightest irritation. The object is, to add exactly so much solution of iron as suffices to destroy the former of these odours, without attempting to remove the latter; a point which, with a little practice, may be readily attained. The whole of the iron is thus brought into the state of peroxide.

The first trial is generally accompanied with some loss of chlorine, and should only be used as a guide to a second and more precise experiment. Accordingly, a weighed portion of the same ore is dissolved, and the chlorine collected as before, except that the solution of green vitriol, in quantity rather less than sufficient, is at once introduced into the inverted tube and capsule. A more ready

and perfect absorption of the chlorine is thus effected, and the subsequent addition of a small quantity of sulphate of iron suffices for completing the process.

The principal sources of error in this method are the two following:—loss of chlorine, by smelling repeatedly, and exposure to the air when the gas is absorbed by pure water; and oxidation by the air when the absorption is made directly by means of the solution of iron. The small flask and inverted tube are apt to retain the odour of chlorine, and should therefore be rinsed out with the absorbing liquid. It should be remembered, also, that a given quantity of chlorine will emit a more or less distinct odour, according as it is less or more diluted. But by operating always in the same manner, and employing such weights of different ores, that equal quantities of the solution may contain nearly equal quantities of chlorine, it is easy to be independent of these errors of manipulation, by causing them to affect each experiment to the same degree. It will accordingly be found, with a little practice, that results of surprising uniformity may be thus obtained; and even the constitution of pure oxides of manganese may be ascertained by this method, almost with the same accuracy as by directly determining the quantity of oxygen. [*Jour. Royal Institution.*

Bent Axle and Dished Wheels.

Extract from an Essay "on the Construction of Wheel Carriages," by J. S. Fry, Bristol, Eng.

"I know no prejudice more firmly rooted than that in favour of dishing or conical wheels. Much has been written, and well written, to show, and to prove, the absurdity of the use of them, but hitherto with very little effect. I think the principles, and the effects of them, may be stated in very few words.

"Carriages are intended to travel straight forward: they ought, therefore, to be furnished with wheels, the natural tendency of which should be to go straight forward. The same with a garden-roller; suppose any man was to have a garden or a field-roller, made six inches less in diameter at one end than the other; what would not even the wheel-wrights say of such a man? Yet such an act would be a counterpart of their own, when they recommend broad conical wheels. The natural course of a rolling cylinder is a straight line; and the natural course of a rolling cone is a circle. Let us reverse their natural courses—that is, let us make a cylinder travel in a circle, and a cone in a straight line. It must be obvious that, when each of these bodies is forced to travel contrary to nature, in the course of the other, there must be a constant dragging, or twist, on the ground, to keep it in its unnatural course. Such would be the case if a man was to drag a common garden-roller round in a small circle; and such, too, would be the case, if a man was to drag straight forward a garden-roller, made six inches less in diameter at one end than at the other. The effect in both cases would be precisely the same. Each operation would be attended with prodigious

labour; and the roller, in each case, by its twist on the ground, would break up and derange the gravel beneath. Now it is well known that the machine constantly in use, in numberless manufactories, as the best that has hitherto been invented for expeditiously and effectually grinding to powder the hardest and toughest materials, is a cylinder forced round in a circle. Therefore, as a cylinder moving in a circle is the best machine that the ingenuity of man has hitherto produced for pulverizing the hardest and toughest materials, and as this is effected by the twist or drag produced between the edge of the cylinder and the surface on which it rolls, and as the twist or drag is precisely the same in the case of a cone forced straight forward, I think I may be borne out in my opinion, that a heavy wagon, with broad conical wheels, is the most complete, the most efficacious machine that the art of man, in the present state of science, could construct for grinding to powder the materials of our roads.*

"And it is also true that, as the wheel grinds the road, in that proportion does the road grind the wheel. The tire of cylindrical wheels, therefore, would last probably many times as long as that of conical wheels.

"It appearing, then, that the cylindrical wheel only has a natural tendency to roll straight forward, all carriage wheels ought to be so constructed. Consequently, the ends of *the axles ought not to be conical, or tapered, nor bent down*, as they are now made; but the axle ought to be put into a lathe, and both ends turned, like the two ends of a spindle for mill work, cylindrical: that is to say, of the same size, or diameter, at the ends as they are at the shoulders; and, of course, the boxes in the wheels should be cylindrical also.

"It should be known that wheels of this construction are liable to only three-fourths of the usual toll, by the 55th Geo. III. chap. 119, at the discretion of the trustees.

"It being shown above that the conical wheels of broad-wheel wagons are the same in operation and effect, on the materials of the roads, as drug-mills, it follows, of course, that all that portion of labour which is applied to the conical wheel, to keep it in a straight course, more than would be required to impel it in its natural circle, is so much power not merely wasted, but most mischievously and most effectually applied in grinding the materials of the road into powder; and as these wagons weigh, in summer, eight tons each, the silent mischief effected by these four drug-mills, of two tons weight each, is great beyond calculation. How much power is thus misapplied may be conceived, as it frequently requires ten of the heaviest horses to draw it—which is just sixteen hundred weight each; a weight sometimes drawn by light horses, in stage-coaches, and at least at three times the pace." [*Mechanics' Magazine.*

* On looking over the Essay on Wheel Carriages, published in the year 1813, by Richard Lovell Edgeworth, I find the same comparison in illustration of the effects of broad conical wheels. But as the above is copied from my own manuscript, written twenty years ago, I hope not to incur the charge of plagiarism.

To restore the Elasticity of Damaged Feathers.

A feather, when damaged by crumpling, may be perfectly restored by the simple expedient of immersing it in hot water. The feather will thus completely recover its former elasticity, and look as well as it ever did. This fact was accidentally discovered by an amateur ornithologist of Manchester. Receiving, on one occasion, a case of South American birds, he found that the rarest specimen it contained was spoilt, from having had its tail rumpled in the packing. Whilst lamenting over this mishap, he let the bird fall from his hands into his coffee cup; he now deemed it completely lost, but, to his agreeable surprise, he found, that after he had laid it by the fire to dry, the plumage of the tail became straight and unruffled, and a valuable specimen was added to his collection.

[*Jour. Royal Institution.*

Meteorological Observations for April, 1831.

Moon.	Days.	Therm.		Barometer.		Wind.		Water fallen in rain and snow.	State of the weather, and Remarks.
		Sun rise.	2 P.M.	Sun rise.	2, P.M.	Direction.	Force.		
				Inches	Inches.			Inches.	
	1	48°	59°	29.70	29.80	West.	Moderate.		Clear day.
	2	41	64	.95	.95	SW. S.	do.		Clear day.
	3	44	68	.80	.80	SE. SE.	do.		Clear.—Overcast.
	4	47	51	.80	.80	S. SE.	do.	·45	Rain drizzle--foggy-rain.
☾	5	45	51	.55	.85	W. NW.	do.		Cl'dy-cl'r [thun. & light.
	6	37	63	30.10	30.10	W. SW.	do.		White frost—clear.
	7	45	67	25.95	29.90	SW. S.	do.		Clear day.
	8	51	68	29.80	.55	South.	Blustering.	.15	Clear—cloudy—rain.
	9	37	44	.20	.40	W. NW.	do.		Flying cl'ds—snow squall.
	10	32	53	.70	.60	W. SW.	do.	.08	Clear—flying cl'ds—rain.
	11	45	50	.50	.50	SW. W.	do.		Cloudy day.
⊗	12	31	41	.76	.85	W. NW.	do.		Clear day.
	13	33	60	30.00	30.00	W. SW.	Moderate.		White frost—clear
	14	40	68	29.96	29.93	SW.	do.		Clear—overcast.
	15	54	62	.80	.90	South.	do.		Rain—cloudy.
	16	55	58	.80	.75	S. E.	do.	2.48	Rainy day.
	17	54	70	.88	.80	NE. NW.	do.		Cloudy—flying clouds.
	18	52	72	.85	.85	NW. W.	do.		Clear day.
☽	19	54	71	.75	.75	West.	do.		Cloudy—brilliant aurora
	20	52	74	.75	.70	S. W.	Blustering.		Cloudy—clear [borealis.
	21	51	60	.70	.80	NE. W.	Moderate.	.03	Cl'dy day—rain in night.
	22	46	64	.70	.70	S. E.	do.	.24	Cl'dy day—thun. shower.
	23	44	55	.70	.70	S. E.	do.	.10	Cloudy—rain in night.
	24	44	54	.70	.70	West.	do.	-	Clear—flying clouds.
	25	45	64	.63	.60	W. NE.	do.		Flying clouds.
☉	26	46	61	.64	.73	East.	do.		Cloudy day.
	27	45	54	.80	.80	N. E.	Blustering.		Cloudy day.
	28	40	43	.50	.50	East.	do.	2.00	Rainy day.
	29	38	51	.33	.35	West.	do.	.05	Rain—cloudy.
	30	45	56	.40	.40	do.	do.		Cloudy day.
	Mean	44.70	59.20	29.72	29.73			5.58	In. of rain in the month.

	Thermometer.	Barometer.
Maximum height during the month,	74. on the 20th	30.10 on the 6th.
Minimum do.	31. on the 12th,	29.20 on the 9th.
Mean do.	51.95	29.725

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

JUNE, 1831.

On the Importance of Hygrometric Observations in Meteorology, and on the means of Making them with accuracy.

[Continued from page 229.]

On the 1st of April last, I hung up in the open air, two unglazed porous earthen pots, one in the sun, and the other in the shade, having first filled them with water.

The water which was used in filling up these pots every day, as it disappeared by evaporation, was supplied from bottles containing a known quantity, and at the end of the month, which was an uncommonly wet one, 37 oz. avoirdupois had been expended from the bottle supplying the pot in the shade, and 49 oz. from the other.

By calculating the number of square inches of surface which these earthen pots exposed to the air, (they are globes of $9\frac{3}{4}$ inches in diameter,) it appears that one inch and eighty-three-hundredths evaporated from the one in the shade, and $2\frac{1}{4}$ inches from the one in the sun. Calculating according to this latter rate, it will be found that 273 cubic feet of water are evaporated per day, at an average, from an acre of humid surface exposed to the sun: or allowing eight pounds to the gallon—2129 gallons per day, through the month of April—and this is probably about the quantity evaporated from 160 square perches of canal.

I am now carrying on a set of experiments which will test the evaporation from canals with more certainty. The quantity evaporated, however, must be much greater during the summer months.

I have constantly used the water in the porous pot kept in the

shade to ascertain the evaporating point, which was explained in the last number of this journal, and I do not yet despair of discovering a method of ascertaining the dew point, from the temperature of the air and the evaporating point alone.

My observations, since my last communication on this subject, will warrant me in saying that, when the temperature of the air is from 60° to 62°, the evaporating point is just half way between the temperature of the air and the temperature of the dew point—and that when the temperature of the air rises above this, the evaporating point is nearer the dew point; and when the temperature of the air sinks below 60°, the evaporating point recedes from the dew point. The exact ratio I have not determined. I have also had the pleasure of witnessing the fall of the dew point previous to every rain which took place during the month of April—and I now consider a sudden fall of the dew point, (unless this fall depends upon a change of wind,) a strong symptom of rain, especially if previous to the fall it stands above the mean of the month. The mean of the dew point for the month of April is 40.9—and for the temperature of the air, about 13 degrees higher, or 54°. For the first seven days of May, the mean of the thermometer was 56.6°, and the mean of the dew point 44.3°. A difference of 12.3 degrees.

In August, 1828, from the 9th till the 19th, the mean of the thermometer was 75 degrees, and the mean dew point 63. A difference of 12 degrees—the dew point ranging from 75° to 51°. During the remainder of the month, the dew point ranged from 72° to 42°, and the thermometer from 94° to 46°, which brings the mean dew point 13 degrees below the mean temperature of the air. This difference is just double what it is asserted to be in Great Britain, (see art. Hygrometry, Edinburgh Encyclopedia.) For there the difference at a mean between the temperature of the air and the dew point, is said to be between 6 and 7 degrees. Hence it will follow that evaporation is much greater here, particularly in the summer months, than it is in Great Britain. Greater, not only on account of the higher temperature, but on account of the greater depression of the dew point below the temperature of the air. It is highly important that this subject should be attended to in the United States. The greatest difference I ever observed, in the summer, though I presume it is sometimes more, was on the 30th August, 1828, two days after a very great rain—the dew point being 54°, and the temperature of the air 84°, at 12 o'clock. The greatest difference of last month was on the 20th, just before a great rain—the dew point being 41°, and the air 74°—amounting to 33 degrees.

The mean of 23 observations taken about sunrise during the month of April, makes the mean minimum temperature 47.3°, that is 7.3° above the mean dew point.

Now, the writer of the article, Hygrometry, referred to above, says, "The mean point of deposition, [dew point,] must be nearly the same as the minimum temperature of any place on a given day." Again he says, "it appears from a meteorological journal kept by the Rev. Mr. Gordon, that the minimum temperature of Perth, and

consequently, the mean point of deposition for that place, is about 6 degrees below the mean temperature, thus coinciding very nearly with the result formerly deduced from theory as the mean point of deposition for Great Britain, and the globe in general." Now my observations clearly prove the incorrectness of these theoretical views, and, of course, of all the calculations founded on them. It is true, on all nights in which there is dew, the bodies on which dew is deposited, must have been cooled down by radiation below the dew point; but even then, the temperature of the air 10 feet above the surface of the ground, may be, and frequently is, 6 or 8 degrees higher—and in all nights in which dew is not deposited, the minimum temperature must necessarily be above the dew point. In fact, nothing can be more fallacious than theory on the subject of meteorology: what theorist would have anticipated a fall of the dew point before rain? Nature must be interrogated, and she will give faithful responses.

I think it probably will be discovered, that the mean dew point for a month, is as far below the minimum temperature as the mean minimum is below the mean temperature—and if so, the mean dew point, the mean minimum, the mean temperature, and the mean maximum, will form an arithmetical progression. Such was the fact during the month of April—the common difference being $6\frac{1}{3}$ degrees, very nearly.

The discovery of this one fact, the falling of the dew point previous to rain, I consider of immense importance in the science of meteorology. It will lead, I trust, not only to the prediction of rain, but to the explanation of many other phenomena, never yet explained. For example, on the 19th of April, about 9 o'clock, a most brilliant Aurora Borealis appeared for a short time; on the same evening, at 6 o'clock, the dew point was taken, and found to be what it had been for several days before, 55°. At half past 8 it was taken again, and found to be 45°, that is, in a very short time, it had fallen 10 degrees. Now that these two things were connected together, as cause and effect, is highly probable. Let observations be multiplied on this subject. The dew point, however, did not stop here; it continued to fall, till the 22nd, when at 6 o'clock, P. M. it was down to 35, and shortly after this, it began to rain.

It is proper to mention here that the porous pot does not give the true evaporating point, when there is a sudden change in the dew point, because it cannot instantly assume the corresponding temperature. Indeed once during the month of April, when there had been a very sudden rise in the dew point, the evaporating point, as taken by the pot, was below the dew point. A skilful observer will be aware of this, and guard against it. I might mention here that the temperature of the water in the pot was once observed to be $2\frac{1}{2}$ degrees below the freezing point; and although the water was agitated by dipping the bulb of the thermometer into it, it did not freeze.

If these observations should meet the eye of the writer of the article, "Hygrometry," mentioned above, I hope he will be induced to observe with greater care whether the mean dew point is really 6

degrees of Fah. below the mean temperature of the air in Europe; for as it is at least double that quantity in this country, and as his theory is undoubtedly wrong in making the mean dew point the same as the mean minimum temperature, I greatly suspect, that upon further investigation, it will be found, that the dew point has been estimated by this writer, too high. In countries where there are heavy dews every night, the mean dew point may approach very near to the mean minimum temperature of the air; but even there the latter temperature must always be a little above the former.

If any gentleman in this country has made observations on the dew point, this most interesting department of meteorology, he will confer a great favour on the public, and particularly on the writer of this article, by communicating the results to the editor of this journal.

From a meteorological journal kept by Mr. E. M'Pherson, at the corner of Chesnut and Broad streets, 45 feet above the level of the sea, it appears that the mean of 22 observations of the barometer, at 9 o'clock, A. M. is 30.026 inches, and the mean of the same number at 5, P. M. is 29.968; the former being nearly six-hundredths greater than the latter: which is in perfect accordance with the theory proposed in my last communication.

I will endeavour to furnish you with observations from Mr. E. M'Pherson's Journal for the month of May, on the dew point, and the evaporating point, with the cotemporaneous temperature of the air;—and if such lines should hereafter be incorporated with the table furnished by your correspondent in Germantown; and an additional line should be added, stating whether there is dew or not—and if, under the head of General Remarks, be added every remarkable phenomenon—particularly how much the dew point falls before it begins to rain—and how much it falls without raining—whether a sudden fall of the dew point is attended with a sudden fall in the temperature of the air,—and *vice versa*—and whether these phenomena do not sometimes occur without any apparent cause from the change in the wind—at what time great rains commence and terminate, and, occasionally, how many degrees a thermometer in the sun rises above one in the shade—and how much colder one is, after dark, exposed on the grass to the open sky, than one not so exposed: then will my wishes on this subject be gratified.

Philadelphia, May 10th, 1831.

On Sharpening Razors by Burnishing.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

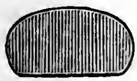
Sir,—In the Journal of the Franklin Institute, Vol. 7, No. 1, for January, 1831, you have given an account of an instrument and process for sharpening razors, &c. By Thomas Andrew Knight, Esq.

I have had the same thing in contemplation for more than seven years, but through disappointment by the instrument maker, have

never brought it to perfection. You were acquainted with my first essays on this subject.

From subsequent experiments, I am fully satisfied that the instrument should be made, not to cut or abrade, but to give a fine edge to the razor by burnishing only; it, therefore, should be made of the finest cast steel, as hard, and polished as highly, as possible; and in the using, it is only necessary to smear it over with a little sweet oil, as a medium to prevent the edge of the razor from coming into too close a contact with the burnisher, and so prevent abrasion. By this procedure I give my razor a highly polished, and an exquisitely smooth edge; and by thus burnishing the edge it is made hard and durable. In other respects it should be used according to the directions of Mr. Knight, to which I refer.

My Burnisher, (exclusive of its handle,) is about $4\frac{1}{2}$ inches long, of an oval figure, with one side flat, like the annexed sectional drawing. The advantages of which are, that the flat side may be used for a soft razor, the broad round side for a harder, and the narrow edges for the hardest: by thus proportioning the surface of the burnisher to the temper of the razor, you gain the best effect.



Sir, yours respectfully,

JOHN MEER.

Philadelphia, May 5th, 1831.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN FEBRUARY, 1831.

With Remarks and Exemplifications, by the Editor.

1. For a *Machine for Cutting Sausage Meat*, and stuffing the same. Samuel Fahrney, Boonsborough, Washington county, Maryland, February 1.

Mr. Fahrney obtained a patent, or patents, for machinery for the same purpose, about two or three years ago, but of a different construction from the present. There was considerable resemblance, however, in the stuffing part, which therefore is not claimed in the specification before us.

The machinery used cannot be well described without a drawing, and this we do not think it necessary to give.

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2. For a *Plough;* John Anthony, Zanesville, Muskingom county, Ohio, February 1.

The patentee says, that he has "invented a new and useful improvement in the manner of fastening, or attaching, the cast iron mould board of the plough, to the wrought iron share." This is all that he claims to have done, and as we are not aware that the improvement is a very great one, we shall content ourselves with telling what he has done, without explaining how it is effected, as we could easily devise several modes of accomplishing the same end, neither of which we should think worthy a patent.

3. For an improvement in the *manufacture of Potash;* Thomas H. Sherman, Hastings, Oswego county, New York, February 2.

We have in this specification the announcement of some magnificant chemical discoveries; one of them is that salt will burn up, and that lime will become potash. Lest those who are adepts should be inclined to doubt, we will give the discovery in the words of the philosopher to whom it is due.

"The compound used is salt, lime, and lamp oil. First, when beginning to melt after the salt has done rising, it can then be ascertained what quantity of potash you are going to have. Suppose one barrel; first take a half a bushel of salt, sprinkle half of it over the top of the potash. Secondly, take two bushels of slaked lime, add that in the same manner, then the remainder of the salt; and when the lime has disappeared, then add half a pint of lamp oil. This is the quantity used for one barrel, but it may be varied as the nature of the case may require. First the use of the salt is to create a heat, and to purify the potash, as it is supposed to burn up and add nothing to the quantity, but to the quality. Secondly, the lime is supposed to melt and become the first rate potash. Thirdly, the oil is to create a blaze to consume. Fifth, these are the contemplated uses of the above ingredients as used by me.

THOMAS H. SHERMAN."

If a patent had been required for deteriorating one of the staples of our country, the one under consideration would most completely have fulfilled the intention; and it is earnestly hoped that its validity may in some way be tested in our courts of law, where we apprehend, it would not be esteemed to be a "useful invention," according to the intention of the patent law; as its inevitable result if acted upon, must be to injure the reputation of American potash in foreign countries; the material would be entirely spoilt as regards its use in many manufactures.

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4. For an improvement in the Cylindrical *Sheet-iron Cooking Stove;* Emma Steinhour, city of Philadelphia, February 3.

The petition informs us that the invention is an "improvement upon the cylindrical sheet-iron stove used in the burning of anthracite; by appropriating the heated air thereof, after it has passed through the body of the fire, to the purposes of roasting, boiling, baking, and performing a variety of culinary operations by means of different apparatus and fixtures."

The foundation of the apparatus is the ordinary round sheet-iron stove, lined with fine clay. Kettles with tubes projecting from their sides, are made to boil by passing these tubes through the sides of the stove. The heated air, instead of being at once conducted off, is to pass through a tube into a sheet iron-box, or roaster, in which meat, &c. is to be roasted. From this a pipe conducts the warm air into a hollow sheet-iron shelf, upon which plates, dishes, &c. may be placed, and from this it is finally carried into a flue, by a pipe. The

top of the stove takes off, and may be replaced by an oven, or by boilers for vegetables.

The claims are to the mode of roasting by heated air; of boiling around or on the top of the stove, and at the same time of baking and roasting by means of heated air; for heating flat irons, broiling, frying, &c.

We have received assurances from persons who tested the goodness of this stove in their own families, and who are well qualified to judge of its merits, that it is well adapted to all culinary purposes; that it is very economical, and that the most delicate food does not acquire any unpleasant flavour by its exposure to the gas which has performed the office of combustion.

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5. For an *Inclined Water Wheel;* William H. Squires, and Coral C. White, Ledyard, Cayuga county, New York, February 5.

This inclined water wheel is placed in the manner of the inclined wheel upon which horses, or other animals, are sometimes made to walk, and propel machinery. Buckets are formed around the periphery, on the upper face of the wheel, and the water is received upon its upper, and discharged on its lower edge.

When the water is low, and a greater power is wanted, it is proposed to place a horse upon the wheel, and thus to obtain the combined action of the animal and the water. When this is to be done the face of the wheel must be floored, and the flooring allowed to cover the inner ends of the buckets.

There is no claim made, and the patentee therefore supposes the whole arrangement to be new; in this, however, he is in error. There has long been in the patent office a model of such a water wheel.

We do not perceive in what particular this wheel possesses advantage over other modes of applying water.

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6. For an improvement in the apparatus for *Applying either simple or medicated Steam to the human body;* Boyd Reilly, Cincinnati, Hamilton county, Ohio, February 5.

This, as will be seen by the title, is a steam doctor's apparatus. The culprit—patient we mean—is to be laid upon a couch made for the purpose, and is to be covered over with a frame made of hoop iron, covered with cloth, &c. so as to have the form of a wagon top. The cloth is to be varnished, to render it steam tight, and is fitted perfectly to the frame of the couch. An opening is left at one end for the head of the subject, and the opening closed around his neck by means described in the specification. A tube from a metallic apparatus for heating the materials to be converted into vapour, opens into the cavity of the apparatus. The vapour of water, either simple or medicated, is sometimes to be used, but the favourite application appears to be sulphur.

The *familiar* tells us that "when sulphur is used it discolours the

skin of the hands, until the scarf skin peels off. This may be prevented, if desired, by having coverings for them of the same material as that for the neck, the penetrating nature of the sulphur causes it to be painful to [parts of great delicacy,] they should be covered by a bag in like manner."

"Although I have made this application some hundreds of times, being a mechanic, I require the patient to take medical advice in cases of difficulty. In simple cutaneous or rheumatic cases, I pursue the following course. If the patient's skin is in a dry state, I generally cause perspiration in a few minutes by steam from half a pint of water;" "the water being removed, a full half ounce of roll brimstone is put into the empty vessel, which in this small apparatus takes as long to burn as the patient can conveniently remain in it." "In this recumbent position the patient seldom feels faint unless previously reduced. Should such symptoms appear, the sulphur may be removed to the back of the fire place, the usual applications being made to the patient, such as admission of fresh air, vinegar, cold water," &c.

It is useless to waste reasoning upon those who appear by their acts, to consider ignorance and temerity as the best diploma which can be exhibited of the skill of a professor of the healing art; and whilst this class of patients is numerous, freebooters will be found in abundance, who, taking advantage of popular ignorance, are ready to sally forth, to "burn, sink and destroy."

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7. For an improvement in *Boxes and Hubs for Carriages*, and in Ship Blocks, and boxes for machinery; Isaac Cooper, city of Baltimore, February 7.

This is a modification of Garnett's friction rollers, but, in our judgment, is no improvement upon them. Round the axle, and within the hub, or box, four rollers are to be placed. These rollers are not to have axles, but are to roll round upon the main axle and within the hub. Between these rollers four others are to be placed, one between each, and of about half their diameter; the whole when together are to fill the circle. The smaller rollers are kept in their places by a flanched ring at each end, to enter which they exceed the larger rollers about an inch in their length.

The claim is, to "the principle of the roller without any axle, as applied to axles, shafts," &c.

This plan will not remove any of the difficulties experienced with similar rollers; as, in Garnett's plan, the axles, which merely confined them in their places, occasioned but very little friction. We err greatly if the rollers without axles will not, by continued use, produce more friction than the former.

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8. For a machine for *bending Tin Hoops and Bands;* Daniel Shepardson, Hamilton, Madison county, New York, February 7.

The bending is to be performed by means of three rollers, in a way well known to workmen. The machine is so constructed that the distance of the rollers may be varied, according to the size of the hoop to be formed. The drawing accompanying the specification is sufficiently descriptive, and has abundant references to it. The written description, however, is extremely meagre and inadequate, and there is no claim made. This is to be regretted, as the particular arrangements appear to have been devised with much skill, and the general principle is not new.

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9. For a *Thrashing Machine;* William Emmons, city of New York, February 7.

This contains all the usual appendages of thrashing machines. The teeth upon the cylinder are to be in rows, and from 1 to $1\frac{1}{2}$ inches long. They are to be bent back so as to form a semicircle, declining from the grain. The hollow segment is to be borne up by spiral springs. The claims are to "the peculiar construction of the cylinder, in contradistinction from any other before known. The form of the teeth turning back in a semicircle. The form and construction of the circular bed, with the teeth, and the manner of setting it on springs."

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10. For a *Thrashing Machine;* Truman Fox, and Wm. G. Borland, Little Falls, Herkimer county, New York, February 8.

We have again a thrashing machine of the ordinary form, with the addition, however, of a fly wheel, which is an appendage not attached to the whole of them; nor is it necessary when the cylinder is weighty and has a very rapid motion.

"What we claim is the construction of the receding concave, by means of springs, or lever and weights; and the staple teeth; and the fly or balance wheel."

The teeth are formed of wire, and bent so as to drive in at both ends, like a staple: this, we believe, is new, but the other parts claimed have so many previous claimants, that it is impossible to designate the true and original owner, though we can with some confidence say who is not so.

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11. For a *Reaction Water Wheel,* for impelling saw mills and other works; Joseph C. Strode, East Bradford Township, Chester county, Pennsylvania, February 8.

(See specification.)

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12. For an improvement in the *Carpenter's Plane;* Phinehas Meigs, Madison, New Haven county, Connecticut, February 9.

The objects to be attained by this invention are to cause a single iron to have the effect of a double iron; and to secure or detach it with greater facility than in the ordinary mode of fastening. The plane is, in fact, a double iron plane of a peculiar, and, undoubtedly,

a new construction. The opening, forming the mouth of the plane, is mortised through in the usual manner, excepting at the ends, which are perfectly flat, as no wedge is to be used. A plate of iron is let in on each end of the mortise, extending from the top to the face of the plane, and secured in its place by grooves, into which its edges fall, and by a screw passing into the stock. A flat plate of iron, similar to the cap of the double iron, has a pin projecting from each side of it, at about three-fourths of an inch from its lower end; these pins pass into grooves prepared for the purpose on the side plates, and a joint is thus formed upon which this cap iron moves; the pins rest upon the bottoms or lower edges of the grooves, which keep the iron at a proper distance from the face of the plane. Near the upper end of this cap piece, there is a thumb screw, which serves instead of a wedge to fasten the cutting iron. The cutting iron is dropped into its place, between the cap iron and the stock; when there, the thumb screw is turned, and its point bearing on the cutting iron, throws the lower edge of the cap against that of the cutting iron, and fixes it in its place; the whole bearing being against the pins in the groove.

The claim is to the peculiarities described.

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13. For a mode of *building Double Ovens in Chimneys and large Bakeries;* Reuben Bacon, and William E. Marshall; Walpole, Cheshire county, New Hampshire, February 9.

In the description given of this double oven, there is a degree of obscurity which we are unable to remove. It appears, however, that two ovens, one above the other, are to be formed of brick or freestone; the top of the lower constituting the bottom of the upper oven. They are to be built in the jamb of a kitchen fire place, as they are thus shown in the drawing; but in this there is no provision represented for using the heat from the ordinary fire, nor are we any where told where the fire is to be made; we learn, however, from the intimation in the claim, that it is to be below the lower oven. This of course disconnects it from the fire place, excepting so far as a flue may be concerned.

The patentees say, "what we claim as our invention, is, the construction of the double oven; or two ovens, one over the other, as hereinbefore described, which are both to be heated by one fire made in, and applied to, the lower apartment of the double oven."

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14. For a *Thrashing Machine;* John Harman, Jr. Upper Wakefield, Bucks county, Pennsylvania, February 11.

The patentee says:—

"In this improvement I claim the concave of plank, channelled and faced with iron; the scourer, or upper concave of plank, channelled and faced with leather, the leather extending from the face of the concave; the beaters made of wood or iron, attached to the cylinder, in a triangular form, so as to strike the unthrashed grain in an angular direction; and the cylinder boxes regulated by screws."

The upper concave, above mentioned, is a semicircular covering to the cylinders, which cover has channels, and strips of sole leather within it for the purpose of rubbing out clover, or other seed. "When this part is used, the seed, &c. enters the machine at the other end from that at which grain enters, is carried upwards by the beaters of the cylinder, and rubbed, or scoured out, between the beaters and leather filletting of the upper concave or scourer."

In other respects this machine resembles the ordinary thrashing machine.

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15. For a machine for *Felting and Napping Hats;* Thomas J. Cornell, Randolph county, Vermont, February 11.

The hat body is to be bowed, set up, and basoned in the usual manner, it is then to be rolled up in the sticking cloth, when it is ready to be operated upon by the machine, which consists principally of a vibrating rack, and a revolving apron. The machine is placed over the kettle, into which a pump passes, the piston of which is operated upon by a part of the machinery, and supplies the hot liquid necessary to the operations of felting or napping. The structure of the different parts, and the gearing employed, cannot be described without drawings. The claim is to "the method of felting and napping of hats by means of a vibrating rack, and a revolving apron."

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16. For an improvement in the *Manufacture of Gas for Illuminating Purposes;* Joseph Barton, of the city of New York, and a resident for two years in the United States, February 11.

(See specification.)

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17. For an improvement in the *Manufacture and Setting of Porcelain Teeth;* Samuel Chamberlain, city of Philadelphia, February 11.

Pieces of platina wire are imbedded in the composition of which the tooth is made, previously to its being baked. These wires project from the top of the tooth, and to them the gold plate is to be soldered, by which the tooth is to be attached. There are some other points which are considered improvements, as will be seen by the claim.

"What I claim as new, and as my discoveries and inventions, are the glazing or enamelling the inside of the tooth, and polishing the gold plate, so that no unpleasant roughness may be presented to the tongue, and the tooth may not absorb moisture from the mouth."

"The manner of fixing the tooth by means of the pieces of platina and gold plate; and by soldering the spring that secures the tooth in the mouth to both the gold plate and the plug in the top of the tooth, which fixes the whole more firmly."

"The method of securing the tooth differs from all others in this essential particular, that is, that there is no interstice between the

plates, or between the plate and the tooth, for food or moisture to collect."

18. For an improved *Machine for Cutting Sickles*, and which may be used with equal advantage and facility in cutting files; Simon Hornbenk, Lafayette, Tippecanoe county, Indiana, February 11.

The sickle, or file, to be cut is laid upon a suitable bed, which is carried forward like the carriage of a saw mill, by means of a rack and pinion. A crank is to be turned by hand, which gives motion to feed hands, operating upon cog wheels, in the ordinary manner. There are four teeth, or lifters, on the crank shaft, for the purpose of raising a hammer, which, in its fall, strikes a punch that is to cut the sickle or file.

For cutting sickles such a machine may possibly answer a good purpose, but for cutting files it is altogether worthless. We speak with confidence upon this point, as machines somewhat similar, but constructed with much greater skill, have been frequently tried. The best which has been made was one executed with the utmost exactness, by the late Mr. Voight, chief coiner of the mint of the United States, who was well acquainted with the nature of file cutting; his machine, however, has never come into use. The best mechanists of England and France also have failed in similar attempts, and that from the inherent difficulty of the subject.

The force of the blow requires to be varied, not only on different pieces of steel, but also upon different parts of the same piece, in consequence of the difference in its texture. The hand of the skilful workman soon becomes habituated to this difference, and adapts itself to these variations; but a machine never can be made to do this, however intellectual its inventor may be.

There is no claim made, and as there is little or no novelty in the machine patented, there was little or nothing to claim.

19. For an improvement in the *Mill for Grinding Corn*, and other grain; Elisha Bigelow, city of Washington, D. C. February 11.

Should the utility of this invention be commensurate with its simplicity, and the brevity of the specification, it will be almost invaluable. *To avoid prolixity*, we will give the whole description, as furnished by the patentee.

"My improvement on the mill for grinding corn, and all kinds of small grain, likewise plaster of Paris, may be applied to all mills which are now, or may hereafter be put into operation. Make an aperture through one of the stones; it is thought best to make a number of apertures through the cap stone, or runner, according to the size of the stones. By this improvement being applied, any required momentum may be given to the stones, and the atmosphere having a free circulation through the apertures will prevent the meal from clogging or heating." "ELISHA BIGELOW."

The drawing represents an upper stone with a number of holes drilled through it.

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20. For machinery for *making Bats for Hat Bodies;* Stephen Hurlbut, Glastenbury, Hartford county, Connecticut, February 14.

The wool is to be received from a common carding machine upon an endless apron, which apron receives a vibratory motion, that it may cross the wool as it delivers it upon the former. "The former is a light wheel, or table, having a horizontal rotary motion; and on the former is a roller; the roller is attached, by a swivel in its centre, to the apron on the former, and its outer or extreme end is secured to the frame of the carding machine, by means of a swivel and wire."

"The operation of the machine is as follows:—The web is received from the doffer of a common carding machine upon the apron. It is carried by the apron to the former, and by the vibratory motion of the apron the web is crossed, as it is received between the former and the roller. The variation in thickness of the bat, for the formation of the body, must be regulated by the feed of the carding machine. The size of the bat for the formation of the body is regulated by a limb from the standard of the apron to which there is a crank pulley. When the bat is completed, it is torn from the circumference to the centre, gradually rolled over, and following the former through one of its revolutions, is taken off without stopping the machinery. The bat is then divided into three equal parts, which forms three hat bodies."

"My claim for a patent is to the whole of the foregoing description attached to the carding machine, and for crossing the webbing, and making the bat."

The drawing which accompanies this specification is a very imperfect one; and is not indeed worthy the name of a drawing, although it serves to give some general idea of the plan. The claim as it stands would seem to include the revolving apron; in this case it appears to be too broad.

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21. For an improved *Machine for Spinning Wool;* David Wooster, Sheldon, Genessee county, New York, February 14.

The common wheel for spinning wool is to be made to turn a number of spindles,—eight are shown in the drawing. The rolls of wool are to be fixed in an apparatus to be held in the hand: this contrivance consists of two strips of wood, 18 or 20 inches long, hinged together, and capable of being opened and closed readily, and in this the rolls are to be secured. There is nothing in the arrangement to recommend it to particular notice, nor is there any claim made.

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22. For a *Thrashing Machine;* Jacob Ketzle, and Jesse Bevier, Ithaca, Tompkins county, New York, February 14.

"What we claim is the teeth in the bars upon the cylinder acting upon the grain over the concave of bars, with or without teeth; and also the cylinder being fixed and stationary, so that it cannot raise or fall except at pleasure."

These claims are no doubt as good as any that could be made to the machine described. The difference between the teeth of this machine and many others, is, that in this, they are made on plates of metal like saw teeth, and fixed along the cylinder.

There has never been a dearth of newly patented thrashing machines, but of late they have sprung up with a rapidity quite unusual; this is to be attributed to the success of one or two patentees, who, if their machines are not of a superior order, have been indefatigably active in bringing them into use.

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23. For an improvement in the mode of *Pressing Cheese,* by a "Lever and eccentric wheel cheese press;" John C. Pulsifer, and Ebenezer Pulsifer, Ipswich, Essex county, Massachusetts, February 14.

An eccentric wheel is placed upon a shaft which crosses the press horizontally; this comes in contact with a roller, or friction wheel, on the top of the follower. When the shaft is turned by a lever, the eccentric wheel is brought into action, and weights hung upon the lever will cause it to operate continuously.

Presses with double and single eccentric wheels, acting exactly upon the principle of the press described, are no novelties. The patentees do not make any claim.

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24. For constructing *Stoves, or Flues, for the Curing or Drying of Tobacco;* D. G. Tuck, Halifax county, Virginia, February 15.

(See specification.)

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25. For an improvement in the *Plough;* Timothy Miller, Pittsburg, Allegheny county, Pennsylvania, February 15.

The patentee states in his petition that his improvements consist in "a moveable piece on the side next to the land, and forming part of the under side, from the heel, or hinder end, to about half the length of the land side, or runner of the plough, which, when worn at the heel, can be renewed at any time, by unscrewing the old, and putting on a new *renovater.*"

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26. For an improvement in the *Overshot Bucket Wheel* used in Hydraulic works, or machinery; D. S. Howard, Lyonsdale, Lewis county, New York, February 16.

(See specification.)

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27. For an improvement in the apparatus for Distilling;

Charles Otis, Tunkhannock, Luzerne county, Pennsylvania, February 16.

(See specification.)

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28. For an improvement in the *Manufacture of Buttons* called "Metallic Shank Buttons;" Josiah Hayden, Williamsborough, Hampshire county, Massachusetts, February 17.

Who is the true and original inventor, or discoverer, of this improvement in buttons, we wot not, but the present patent is taken for the same mode of making buttons as that described in the last number, (No. 22 on the list,) and such is the resemblance in matter and manner, that it is probable they are both from the same mind, although the claimants reside no small distance apart.

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29. For an improvement in the *Steam Boat Paddle Wheel;* Timothy Hunt, Boston, Massachusetts, February 17.

This is another patent for a mode of causing the paddles of steamboat wheels to enter and leave the water vertically. The general arrangement is similar to that of several others which have been patented both here and in England. Two wheels eccentric to each other operate upon the buckets; the particular arrangements in the present case are made with great skill; the specification and drawing fully and clearly present the whole design, and the parts claimed are distinctly designated: we apprehend, however, that the practical difficulties which have prevented the adoption of similar plans, will not be removed by that before us.

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30. For an improvement in the *construction of Steam Boilers;* Levi Disbrow, city of New York, February 18.

(See specification.)

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31. For a mode of *constructing the Rotary Steam Engine,* called the "Double Chamber Rotary Steam Engine;" Joel Eastman, Bath, Grafton county, New Hampshire, February 18.

The patentee informs us that "the rotary or revolving part of this engine may be constructed in various ways, not essentially differing from other rotary engines; the distinctive character of my engine being the employment of two chambers upon the same shaft, by which the action upon the fixed heads, is rendered equable."

The steam is admitted and discharged through openings in the fixed heads; and to them are attached the metallic stops which fill the chambers, and cause the steam to react upon the valves. Instead of the ordinary stuffing, it is proposed to close the juncture between the revolving cylinder and the fixed head, by driving wood, endwise of the grain, into a groove prepared to receive it, which being turned off, is to run against the metal.

The claim is to "the employment of two chambers on the same

shaft, in which the heads that form the exterior ends of the chamber are fixed, or stationary, and by the use of which two chambers the force or action upon each end is equalized."

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32. For a *Water Wheel for Mills,* in which the floats work upon hinges, or joints, and are enclosed within the rims of the wheel and a circular apron; Joel Eastman, Bath, Grafton county, New Hampshire, February 18.

"This water wheel may be made of cast and wrought iron combined; its diameter may vary from two to six feet. The rim of the wheel is to be partially surrounded by a circular case, or apron, which will confine the water within the rims, and between the buckets or floats. The floats are made to work upon joints, or hinges, and the water is conveyed on to the buckets, or floats, through a penstock, or close trunk, extending the whole height of the fall. The buckets, or floats, are to be opened and closed by apparatus appended to the wheel, to the frame, or to the plummer block on which it rests."

The junctures of the revolving parts are to be closed by strips of wood, driven into grooves, as in the foregoing article.

The claims are to the application of a water wheel constructed as above described; that is, with floats or buckets, which are opened and closed mechanically, independently of the action of the water, and the confining the water within the rims, by means of a case, or apron, whilst operating upon the floats, or buckets.

The motion of the buckets upon their hinges is effected in a manner similar to that of the valves in several rotary engines.

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33. For a *Machine for Pointing Pegs for Boots and Shoes;* William A. Greenwood, Palmer, Hampden county, Massachusetts, February 19.

Although the drawing which accompanies this specification represents the whole machine very well, yet those parts upon which its operation principally depends, are neither shown or described in detail. There is a part called the cutter, which is to point the pegs, and, we suppose, from the general representation, that it operates like a plane, with a sharp angle, and grooves the end of the block which is to be split into pegs. A carriage upon which the block is placed is made to advance by regular steps, as the cutter works. The whole is set in motion by means of a crank. The claim is to the whole of the foregoing machine.

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34. For an improvement in the *Sawing of Boards* by means of a machine called the Economical Sawyer; Reuben Jacobs, Wilton, Saratoga county, New York, February 22.

"The objects proposed to be accomplished by the economical sawyer, are to saw boards and other timber without a stubshot, and to gauge the thickness of the board, or other thing, into which the

saw log is to be sawn, and to keep the saw log plumb while it is being sawed."

The mode of effecting these objects is particularly explained in the specification; the head blocks of the carriage of a common saw mill have the dogs so constructed and arranged, and there is a rack and pinion for the purpose of moving the log, constructed in such a way as to attain the proposed ends. The claims are to the particular parts represented as the invention of the patentee.

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35. For a *Machine for moving Earth, Stones, &c.;* Shadrach Davis, Dartmouth, Bristol county, Massachusetts, February 22.

The body of this machine resembles the common scraper used for removing earth; but, instead of a straight cutter, the edge is formed into points like those of the shovel plough, which are intended to cut the ground more easily than the ordinary cutter.

It is proposed to mount this scraper upon a carriage, with wheels, so constructed, that by means of shafts and chains acted upon by levers or cranks, it may be lowered, to allow its points to enter the ground, and that when loaded it may be raised and removed where required. When the earth is to be deposited in the vicinity, it is to be used, like the common scraper, without a carriage. The claim is to "the points, or shares with cutters in the fore parts; and the application of said scraper to wheels, and the form of hanging it; together with the applying of said points to scrapers drawn without wheels."

The drawing accompanying this specification, which is referred to throughout, is wretchedly executed, leaving most of the parts, and all the particulars, to the imagination.

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36. For an improvement in making *Bedsteads;* Rufus Belt, Centreville, Bourbon county, Kentucky, February 22.

The great improvement here claimed has been so often patented, that if the mere act of patenting will afford security, it must by this time be well secured. On one end of each rail there is to be a right hand, and on the opposite end a left hand screw, which are to screw into the opposite posts by turning the rail one way. Were the contrivance new, it would still be a poor one, and we apprehend that age has not improved it. Those who know any thing about cutting screws, especially in wood, are aware that it is nearly impossible to cut two which should bring up to the shoulder correctly, and that were they made to do so at first, they would still wear and strain unequally.

There have been at least three patents for this very same affair granted within three years.

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37. For a *Fire Engine;* Nathan Pierce, Whitehall, Washington county, New York, February 23.

Two cylinders are to be used in this engine, each of which is to act as a double forcing pump; having a supply and a discharge pipe at each end, with their proper valves, and the piston rods working through stuffing boxes. The four supply pipes terminate in one common suction pipe, and the four discharging pipes also unite in one.

It is proposed to work this pump by turning a crank, or cranks, from the shaft of which pitmen operate upon the pistons of the barrels. No mention is made of an air chamber. There is no claim made, but we are told that "some among the many advantages of an engine constructed upon the principle above mentioned, over any that have previously been built, are, that the cost of building it will be much less; that a more uniform and constant stream of water may be forced out; that the friction is so much less, and the machinery so simple, that it is believed that not more than half the power necessary to work an engine upon the old plan, will be requisite for this; and, finally, that it will be much less liable to get out of repair than any that have been made upon different principles."

It would have been more satisfactory had the patentee told us for what, in particular, he takes his patent; we suppose, however, that it is for the *application* of one cylinder as a double forcing pump, to the fire engine, as in the principle of the pump there is nothing of novelty.

We are compelled to dissent from most of the conclusions at which the patentee has arrived; we cannot conceive that a pump with eight valves is more simple, or less liable to get out of order, than one with four, or that pistons which are to work water tight through stuffing boxes, will require as little attention as those with open cylinders. We are also of opinion that the engine must cost more than the ordinary double chamber engine; and a *more* uniform and constant stream of water than is thrown by a well made fire engine of the usual construction is scarcely possible, and certainly impossible without an air vessel.

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38. For an *Axletree* for wheel carriages of all descriptions; Rezin Haslup, Baltimore, Maryland, February 24.

The axle is to be divided into two parts, and is to run in collars upon the carriage, instead of in boxes in the wheels. The end of the axle which enters the wheel is to be square, and fixed permanently in it.

There is no claim, and axles have, in many instances, been fixed in this manner; what there is of novelty in the proposed mode of doing it, we are unable to discover. In Eastman and Rix's wheel, mentioned at p. 252, the axles are so fixed.

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39. For a composition of matter to be used in the art of *House, Coach, and other Painting;* Chandler Metcalf, Hanover, Grafton county, Maine, February 25.

"The compound, or composition of matter, is to be used in mixing paints and putty. Take one gallon of common soft soap, or a

sufficient quantity of bar or brown soap to make a gallon of soft soap, add six gallons of rain or river water, having previously dissolved in the water one ounce of sugar of lead to every gallon of water; mix these ingredients well together; then add, for outside painting, six gallons of raw unadulterated linseed oil; or a less quantity of oil will answer for old buildings, and rough kinds of work. With this composition mix, or combine, paints formed from or combined with lead, as well as all other paints or colouring substances used in painting. The paints to be ground, mixed, and laid on in the same way and manner as when mixed with clear oil, as has been heretofore practised. For painting oil cloth, coaches, signs, insides of houses, &c. where the paint is required to dry expeditiously; instead of using all raw oil, as above, use a part, or all, of boiled oil; in all cases thinning the paint with the above composition, or spirits of turpentine."

The foregoing is the whole of the descriptive part of the specification. What benefit the soap is to produce we are not told, but its effect, undoubtedly, must be to render the paint less durable, or more readily acted upon by water. We see no difference between mixing soap with the oil, or adding to it a portion of caustic potash, which should convert a part of it into soap, and thus render it miscible with water.

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40. For an improvement in *Mortise Door Fastenings;* Leonard Foster, Boston, Massachusetts, February 25.

This is to be a substitute for the common mortise lock; but it is to be so constructed as not to occupy more than half the width, or thickness, usually required for such locks; adapting it, therefore, to thinner doors, and weakening the door much less than ordinary.

The bolt is to be shot forward either by a turning or sliding knob, which projects through the escutcheons. The escutcheons are to be made of metal plates, three inches square, and as the body of the lock is but two inches, the screws by which these are fastened enter the solid parts of the door, above and below the lock. On the inside of the door there is a small bolt which enters the main bolt, and secures it in its place. When it is desired to have the door to lock on the outside, a small lock, like those used for drawers, is fixed under the bolt of the mortise lock, which has a notch in it to receive the bolt of the small lock. The advantage, thus obtained, is the carrying of a small key instead of a large one. To enable the bolt to spring back as the door closes, the plate on the door post is made to slope, the thickness of the bolt itself not being sufficient for that purpose.

The claims are to the construction and arrangement of the various parts of the door fastening.

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41. For improvements in the *Printing Press;* Amos Sherman, city of New York, February 26.

The cheeks and cross timbers of this press resemble those in com-

mon use. The platten is worked by a toggle joint, and borne up by spiral springs in the manner of many of the modern presses. The handle, or lever, is fixed upon the middle of the near cheek, and when the platten is raised, its position is nearly vertical. The pull is downwards, which the patentee says is the most advantageous way of working. There is a mortise made through the cheek, through which a rule joint passes, and upon this the lever acts, which operates upon the toggle joint.

The press is double, having a form, inking apparatus, frisket, and other appendages on each side of the platten. There is a rounce also on each side, as it is intended to employ two men to work the press, and two girls to attend to the sheets. The two parts are connected by iron bars, which can be removed, and the press worked as a single press, when desired. The claims are in the following words.

"First, I claim that part of the press as I have described it, forming a single combination; its main parts consisting of the bar handle, the two upright pieces, and the two horizontal pieces. I do not claim the bar handle, nor either of the four pieces abstractedly, but I claim the bar handle as used by me in its upright position, that position being the easiest for working. I claim the bar handle and near horizontal piece as united by me by the joint; regard being had to their relative situations and the purpose they serve. I claim the two upright pieces and farther horizontal piece, as they are moved by the near horizontal piece, and as the further horizontal piece is united to the near horizontal piece. I do not claim the toggle joint abstractedly, but I claim it as constructed and moved in the peculiar manner I have described it, with the horizontal piece between the two upright bars.

"Second. I claim the cylinder for winding up the blanket, not abstractedly, but for this purpose, and also for drawing out the frisket. I claim the roller with its bellying form, inserted in the cylinder, and the channel in which it revolves, and the union of the roller and cylinder for the purposes which they serve. I claim the blanket, not abstractedly, but as made in one piece, and placed as I have described it, held at one end by the rollers, and at the other by the lath. I claim the lath with its bellying edge, for the purpose of holding and straightening the blanket. I claim the guides of the lath for the purpose which they serve in being forced towards the platten by the frisket guides, and forcing the frisket guides from the platten. I claim the hooks on the corners of the bed, the guides on the corners of the frisket, and the ways containing channels in which the rollers run, as I have described them, and for the respective purposes which they answer in carrying in the frisket and blanket. I claim also the ways containing grooves in which the guides of the lath and frisket run for that purpose.

"Third. I claim the union of two beds in one press, pressed alternately by a single platten; and the union generally of the two halves of the press, for the purposes for which they are united. I claim

the bar uniting the two beds, and the arrangement of the tail irons between the beds, to prevent the tail irons from interfering.

"Every other part of the press described above, except what I have thus claimed as my own invention, is not mine; but I declare the same to be old, and known before this my application."

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42. For improvements in the *Steam Engine;* Hugh Gordon, city of New York, an alien, but having resided two years in the United States, February 27.

The steam engine of which this purports to be an improvement, is the vibrating engine working upon trunnions on the centre of the cylinder.

The patentee says, "the only parts and combination of parts of the above described engine which I claim as my improvements, are the following, namely, the double packed joint aforesaid, and the combining the vibrating engine with the double steam chest and slide valves, together with the opening and shutting of the steam passages by forming a connexion between the valve rod, and a detached standard at rest, by means of connecting rods, a forked lever, and a moveable standard."

Accompanying the specification are ten distinct and well drawn figures, explaining the particular arrangements adopted by the patentee; as these are all things of mere detail, they cannot be explained without engravings.

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43. For an improved *Pendulum Churn;* Caleb Angevine, city of New York, February 28.

The churn is the common dasher churn, the rod of which is to be worked up and down by a pendulum. A frame is to be made, across the upper part of which there is to be a shaft turning upon gudgeons; from this hangs a weighted pendulum. The shaft is crossed by a lever, one end of which is attached to the dasher rod; from the other a pitman descends to a treadle. The pendulum may be made to vibrate by the hand; or the foot may be placed upon the treadle for the same purpose. The claim is to "the application of the pendulum principle to the dasher, which equalises the power applied, and assists in passing the reacting points in the rise and fall of the dasher; and also in the application of the foot power, which relieves the arms and chest in the act of churning."

We apprehend that this machinery would be improved by removing the frame, the shaft, the pendulum, the pitman, and the treadle, and taking hold of the dasher by the hands, as dairy maids have been in the practice of doing from time immemorial.

Specifications of American Patents.

Specification of a patent for a Machine for Impelling Saw Mills and other works by water, called Strode's Reaction Wheel. Granted to Joseph C. Strode, *Teacher, East Bradford, Chester county, Pennsylvania, February* 8, 1831.

There is a wooden shaft seven feet six inches long, sixteen inches in diameter at the larger end, and fourteen at the smaller; in the centre of this shaft, is made a round hole eight inches in diameter at the larger end, and six at the other; the area of this hole will vary directly as the power required, and inversely as the subduplicate ratio of the height of the head above the centre of the shaft.—*a, a, a, a,* are six hollow arms, six inches in diameter, set perpendicularly in the shaft, A, at equal angular and linear distances, forming a true spiral curve from one end to the other. The holes through these arms are three and a half inches in diameter. Near the end of each arm is a hole one and three-quarters inch in diameter, so situated that the axis of the shaft, A, is perpendicular to the plane passing through the axis of the hole and that of the arm, and so that a plane passing through the axis of the hole perpendicular to the aforesaid plane, shall be a tangent to the circle formed by the middle point in the axis of the hole, by the revolution of the machine on its axis. The distance of the centre of this hole from the centre of the shaft, is thirty-three inches, and will vary directly as the power required and the subduplicate ratio of the height of the head above the centre of the shaft, A, and inversely as the number of revolutions desired. The area of the hole will vary inversely as the subduplicate ratio of the height of the head, and directly as the power required. The distance between each two of the planes passing through the axis of the arms to which the axis of the shaft, A, is perpendicular, is eleven inches, and will not answer to be nearer, because the water from each arm nearer the larger end would impinge against the back of the next arm, and thereby impede its motion; so that if the number of arms be increased, the length of the shaft must be increased in proportion.

The arms are made fast in the shaft by means of a tennon with a dovetail, as represented by figure H, the side of the tennon on which the dovetail is made is rather narrower than the opposite side, and the mortise in the shaft is of the same shape, so that when the wedge, I, is driven in on the side opposite to the dovetail, it will be firm and tight on all sides.

B, is a hollow cylinder eight inches in length with a rim on one end, one inch and a quarter wide, and three-quarters of an inch thick. The diameter of the hole is eight inches, the same as that in the shaft A. Its diameter from out to out is nine inches and a half, half its length; the other half, or the part *h,* is nine inches and a quarter at the shoulder where *g* terminates, tapering to the end, where it is nine inches. This cylinder is let through the plank,

D, of the trunk, which is three inches thick, with its rim on the inside, which is sunk in the plank three-quarters of an inch deep, or so as to face with the inside of the plank. It is made at the same time firm and water tight by means of eight screw bolts, each three inches and a half long, driven in from the outside through holes made in the rim, where it is screwed up firmly and rendered tight by means of burs. The part *h*, is four inches in length, and goes into the cylinder, F, which is of the same length, and is made fast in the shaft. It has four wings to keep it from turning. This cylinder is of such a capacity that it will work easily on the part *h*, and at the same time not allow too much play. G, is a lead washer one inch and a quarter wide, three-eighths of an inch thick, and its inner diameter eight inches. This washer and an iron follower of the same dimensions, are screwed against the ends of *h* and F, (which are turned so as to face exactly,) by means of eight screws going through them and securing into the end of *h*. This is in order to render them water tight.

B, is a cast iron friction wheel, fourteen inches in diameter, running with its periphery, which is turned true, against the iron band F, on the shaft, (the band being also turned,) thereby supporting the weight of the shaft, A, to prevent too much friction on the gudgeon, *h*, of figure E. The gudgeons of the friction wheel run on the middle of the two cross pieces, *d* and *e*, made of wood, which are supported by the upright pieces, *b*, *b*, of plank, two inches thick, spiked at the bottom to the sill, C, and made firm at the top by the inch board, *c*, going across from one to the other and nailed to each.

In the foregoing description are given the dimensions of a machine now in operation, for impelling a saw mill under a head of twenty feet. If a larger or smaller wheel is required, the dimensions of the several parts will vary according to the proportions given.

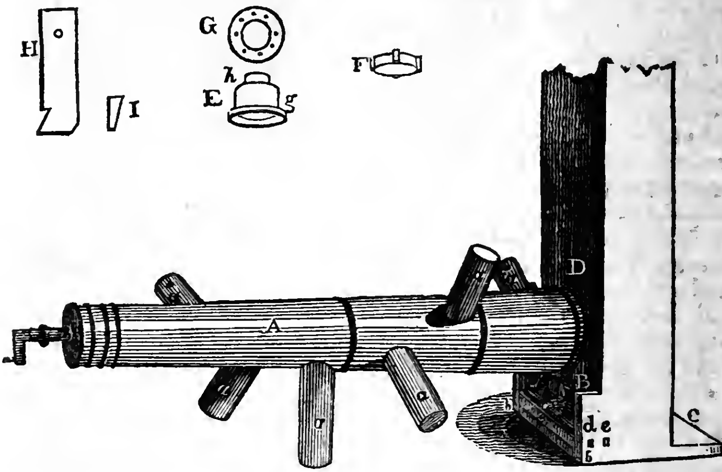
Some additional power may be obtained by the application of a funnel to each of the holes in the ends of the arms, *a*, *a*, *a*, *a*, &c. the small end of the funnel being applied to the hole, and the wide end standing outward. These funnels may be of small blocks of wood with a hole bored through the middle of each, and hollowed on the inferior side so as to fit the arms to which they may be attached, firmly, by nails or screws. The holes in the blocks should correspond in capacity and position on the inferior sides with the holes in the arms, and should gradually widen in the true funnel shape towards the outer surface of the blocks. These funnels may, or may not, be attached, at the option of the constructor; the machine will operate very well without them, though it is believed, from experiment, with some increase of power with them.

If a reciprocating motion is desired it may be obtained by means of a crank on the axle of the shaft A. In the machine above described the crank is at the end of the axle: but if the axle a little prolonged, be made to work on a point fixed in a permanent block placed directly opposite the smaller extremity of the shaft, and in the intermediate space between the end of the shaft and the block, the axle be so shaped as to form a crank, by which the reciprocating

movement may be given, there will be less friction and consequently a gain of power.

Joseph C. Strode.

Strode's Reaction Wheel.



Specification of a patent for a mode of constructing Flues, or Stoves, for the Curing or Drying of Tobacco. Granted to David G. Tuck, *Halifax Court House, Virginia, February* 15, 1831.

To all to whom these presents shall come:—Be it known, that I, David G. Tuck, have invented, or discovered, a new and useful improvement in the construction of flues, or stoves, for the curing or drying of tobacco, by which the whole or greater part of the smoke, as may be preferred, is excluded, and the expenses consequent upon the process very much diminished; and that the following is a full and exact description thereof.

The material of which I usually construct the said flues or stoves, is common brick, as, under most circumstances, it is more readily obtained, and is less costly than any other. They, however, may be made of stone, iron, fire brick, slabs, or tiles, made and baked in the manner of brick, or of other materials.

The dimensions of my said flues, or stoves, must be varied to suit the size of the barn, or drying house, in which they are to be used; and they will also admit of considerable variation in this particular in houses of any size, whilst the principle of construction may yet be retained. For the sake of description, I assume certain dimensions, which I have found to answer the intention perfectly, but do not intend to establish any limit in this particular.

These stoves, or flues, are to be so constructed that they may be

supplied with fuel from the outside of the house, and that the smoke, and other vapours from the fire, which it may be desirable to exclude from the interior of the building, shall, after passing through the larger flue, or stove, in which the fire is contained, to a spot near the centre of the building, return through a second, but smaller flue, which may be parallel to, and in contact with that first named, and be delivered, or have its exit, near the opening for feeding the fire.

Suppose my barn to be twenty feet square, and of the ordinary height. Near the middle of one end, or side, of the barn, I make an opening for the mouth of my flue, or stove; this flue, or stove, is a square, or arched trunk, about 30 inches in width, and the same in height. It is built horizontally upon the floor of the barn, and extends within it to the distance of about seven feet from the wall. The outer end, where the fire is to be fed, is furnished with an iron door of about a foot square. To receive the inner end of this flue, a square, or other formed pen, or box, is erected of brick, or other materials. This pen, or box, may be four feet in length, and two in width, and of the same height with the larger flue, or stove, which terminates in it. It should stand at right angles with the flue, or stove, which is to enter it on one of its broad sides. The smaller flue, through which the smoke is to return, also opens into this box, or pen, alongside of the large flue, and may return, and pass through the building, in the vicinity of the fire place, or feeding door. This second flue may be made of the same materials with the former, but need not be more than one-fourth of its size. From the end of it, a flue, or pipe, is erected perpendicularly to the height of four or five feet, to serve as a chimney to furnish a draft, and carry off the smoke. The interior diameter of this chimney need not exceed seven or eight inches; and an iron plate, or some other flat article, must be provided to stop the draught when required, by being placed upon the top of said flue.

It is manifest that in a structure of this kind, a fire may be made, and that the smoke will pass out at the chimney; but as soon as the wood is charred, and the fire burns clear, it is intended to admit the heated air into the barn, and to stop the draught through the flue, or chimney. For the purpose of admitting the heated air, the pen, or box, before described, is provided with an iron, or other door, or stopper, opening from it into the barn. This door may be twenty inches square; it may be fixed by hinges, or otherwise, so that it may be opened as soon as the smoke has ceased to escape from the chimney, and at this time the top of the chimney may have its cover placed so as entirely, or partially, to stop the draught through it.

A second flue, or stove, constructed exactly like the one just described, with all its appurtenances, is to be erected on the opposite side of the barn. The pens, or boxes, forming the termination of each of these flues, or stoves, will thus leave a passage of about two feet between them, on the centre of the floor.

These flues, or stoves, may be used either separately or conjointly; it will be found best, however, always to make a fire in each, as

there will then be no interval in which the heated air from the fire may not be admitted directly into the barn.

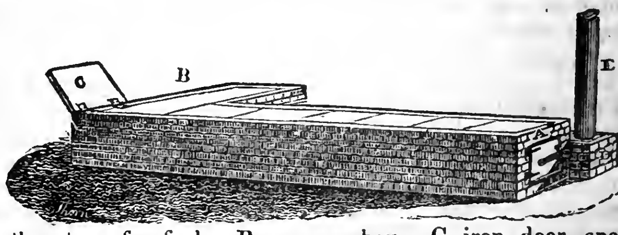
The manner in which the heat may be regularly distributed, and applied to the curing of tobacco, is fully described in the specification of a patent for a new mode of curing tobacco, which was granted unto me on the 1st day of October, 1830. To the system, or mode of procedure therein described, these flues and stoves are particularly adapted, but they may also be used when tobacco is cured in the ordinary way.

Where flues are carried directly through a barn, or drying house, the draft cannot be advantageously managed, and most of the heat is lost; a difficulty completely obviated by flues, or stoves, constructed upon the principle above described.

What I claim as my invention, or discovery, is the application of flues, or stoves, constructed upon the within described principle, by which the heated air from the fuel may be admitted, directly, into a barn, or drying house, for the purpose of drying and curing of tobacco, whilst the smoke may be entirely excluded. I also claim the returning of the draft of the flue, or stove, to a point, at or near to the feeding door of the stove, by means of which the draft of the fire is readily and perfectly managed, so as to produce great economy in the use of the fuel.

The escape flue, however, may be carried out at any part of the building, although not with equal advantage. It may, for example, be carried directly through the house, and yet the main object of my patent, that of admitting the heated air without the smoke, may still be attained. D. G. Tuck.

D. G. Tuck's Stoves or Flues.



A, the stove for fuel. B, pen, or box. C, iron door, opening into the barn. D, return flue for smoke. E, pipe, or flue, to carry it off.

Specification of a patent for an improvement in the construction of a Bucket Water Wheel, used for the purpose of giving motion to hydraulic works, or machinery. Granted to Dean Samuel Howard. *Lyonsdale, Brantingham Township, Lewis county, New York, February* 16.

A common bucket water wheel is well known to be a series of buckets suspended at the end of a certain number of arms passing

through a shaft hung up at each end by gudgeons, or pivots. The inside of these buckets is formed by the lining of the wheel; the bottom is a narrow board varying in width with the size and proportion of the wheel, with one edge jointed to the lining, and the other edge extending directly from the centre towards the circumference until it meets the front, which inclines from the circumference inwards on a straight line in a sectional direction till it meets the bottom, which forms the bucket.

Section of a part of Howard's Bucket Wheel.

The improvements thereon are as follows:

The bucket is detached from the lining of the wheel, so that the air has free access from one bucket to the other all around the wheel; the front is a board warped, or bent, in such a manner as to take and retain more water, longer than the common wheel; the front is wider than the back, so that all the surplus water must escape over the back, and none be thrown out by the centrifugal force. All the surplus water is directed into the bucket below, (which will hold more as the wheel turns,) by a board for that purpose forming the lining to the wheel and extending down by the back of the bucket. If thought necessary, the air might have access through the lining to each bucket.

D. HOWARD.

Specification of a patent for an improvement in the construction of Steam Boilers. Granted to LEVI DISBROW, *city of New York, February* 18, 1831.

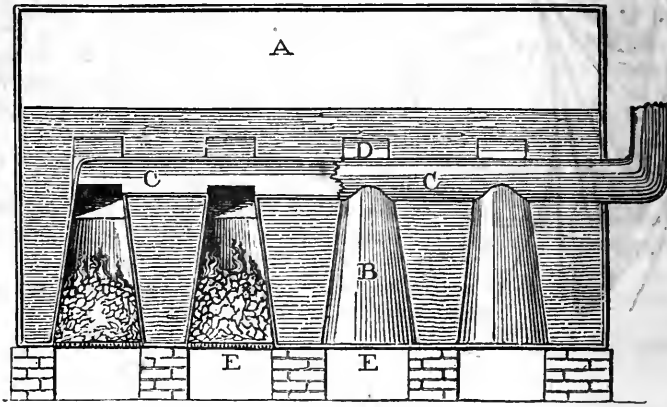
THE object of this invention is the advantageous application of anthracite, or other, coal, to the purposes of heating water in the boilers of steam engines. The boiler may be made of cast iron or any other usual materials, of any dimensions adapted to the purpose. The water contained in the boiler is heated by means of two, or more, furnaces of a conical (or other) form, erected within the boiler, having their bases, or the grates through which the ashes fall, upon or near the same level with the floor of the boiler. The smoke or gas is discharged from the top of the furnaces, by one or more horizontal cylinders passing through the boiler to its outer surface. Each furnace is replenished with coal by means of a pipe or feeder of a cylindrical or other convenient form, passing from the outer surface of the boiler through the same into each furnace at, or near, its top. Each of such pipes is secured by a door, or other means, at the surface of the boiler, and fixed to the furnace with a flanch or other suitable connexion; and the horizontal cylinders above mentioned

are also secured to the top of each furnace with a suitable flanch or connexion.

The said Levi Disbrow claims as his invention the advantageous application of heat to the boilers of steam engines, by means of two, or more, furnaces for anthracite, or other coal, erected within the boiler itself; and as parts of the same invention, he claims the mode of supplying such furnaces with feeders passing into them from the surface of the boiler, and also the mode of discharging the gas or smoke of the coal by a cylindrical pipe, or pipes, extending from the top of each furnace to the outer surface of the boiler.

LEVI DISBROW.

Disbrow's Steam Boilers.



A, boiler. B, B, furnaces. C, C, pipes for smoke. D, D, feeders. E, E, grates.

Specification of a patent for an improvement in the apparatus for Distilling. Granted to CHARLES OTIS, *Tunkhannock, Luzerne county, Pennsylvania, February* 16, 1831.

To all whom it may concern, be it known, that I, Charles Otis, have made an improvement in the apparatus used for distilling, and that the following is a full and exact description of the same.

The still may be constructed in the ordinary manner. A tube is to lead from the beak of the still into a tub, or vessel, which contains low wines. The top of the tub is made to fit steam tight, and the before mentioned tube passes through it, being also so closely fitted as to prevent the escape of any vapour around it, and extending nearly to the bottom of the vessel. The vapour from the beer which is contained in the still, will thus pass into the vessel containing the low wines, and cause the liquid to boil.

A tube leads from the upper part of the vessel of low wines, into a second tub containing a still worm, and called the heater. This

heater is to be filled with the beer with which the still is to be charged. This beer becomes heated in consequence of the partial condensation of the vapour, in its passage through the worm. This heater is to be elevated, so that a tube inserted near the bottom of it may convey the heated beer into the still, when it is ready for a charge. From the worm in the heater the spirit is conducted through a cooler, in the usual way.

By this arrangement of the distilling apparatus, the low are converted into high wines, by the operation of the vapour of the beer contained in the still.

I usually insert the still in a second vessel, so as to distil by a water bath; in this case I economize heat by conducting the steam from the second, or outer vessel, by means of tubes, so as to heat a second still, or to aid in performing other operations in the still-house, to which it may be applicable. Sometimes I convey the steam through a tube, provided with a cock, from the outer vessel into the still. This, however, I do not claim as making any part of my invention.

What I claim as new, and for which I ask a patent, is the conducting the vapour from the first distillation of the beer, into a vessel containing low wines, in the manner, and for the purposes hereinbefore described.

CHAS. OTIS.

Note by the Editor.—We do not perceive the difference between the plan here specified, and that of William Cook, which will be found in Vol. 5, p. 157. That patent was issued in December, 1829.

Specification of a patent for an improvement in the Manufacture of Gas for illuminating purposes. Granted to JOSEPH BARTON, *city of New York, an alien, but a resident in the United States for two years, February* 11, 1831.

BE it known, that I, Joseph Barton, have discovered a new and useful improvement in the manufacturing of gas, for illuminating purposes, and of a portable nature, and that the following articles are used as a combination to produce said gas without smell, viz.

Tallow, spirits of turpentine and rosin fused together, and decomposed through red hot tubes.

Turpentine and alcohol,	do.	do.
Coal tar and rosin,	do.	do.
Coal tar and tallow,	do.	do.
Coal tar, tallow, and rosin,	do.	do.
Seneca oil, coal tar, tallow, and rosin,	do.	do.
India rubber and Hydro carbons,	do.	do.
Oil of turpentine and rosin,	do.	do.

The foregoing substances contain gaseous matter, which when mingled with the pure illuminating principle, diminish its intensity,

and increase its bulk. The application of the combinations heretofore enumerated, is to unite two or more of these hydro-carbons, and decompose the mixture so as to form a compound on which chemical agents will act so as to separate the deteriorating from the beneficial, viz. spirits of turpentine by its decomposition furnishes the pure illuminating principle, (Carburetted Hydrogen,) mingled with free hydrogen, and carbonic oxide gases, both destitute of illuminating principle or properties, but with the addition of a small portion of rosin previous to decomposition, the carbonic oxide is converted into carbonic acid, which may be entirely removed by washing with an alkaline or earthy lixivium, and if to this a small portion of tallow, or oil, be added, it will have the effect of converting the free hydrogen which the mixture still contains, into pure carburetted hydrogen, which will be perfectly free from smell or smoke. If alcohol be added to turpentine, and the gaseous mixture resulting from its decomposition be passed through an alkaline lixivium, and thus purified from carbonic acid and other deteriorating gases, the gas thus produced will be the pure illuminating principle, which when compressed by a peculiar process into copper recipients with valves, may be made portable and applied to all uses where light is essential.

The method of making illuminating gases by a union of two or more vegetable, animal, or mineral hydro-carbons has never before been suggested or acted upon.

Joseph Barton.

Remarks by the Editor.—We were placed upon tiptoe, some months since, by the announcement in the New York papers, that a chemist of that city, Mr. Barton, had made some important discoveries in the making and using of gas, for illumination, and if we had not learned from experience to chasten our anticipations, the result would have been sore disappointment. There is not a single fact, or principle, noticed in the foregoing specification, with which every chemist was not perfectly familiar, and therefore there is not a point in it which can lay the slightest claim to discovery.

We are first told that the gas is "of a portable nature." What does this mean? How much more portable is it than the gas from oil, or from rosin, made at the New York gas works? If the patentee supposes, as he evidently does, for he makes it the very foundation of his claim, that two or more oleaginous, bituminous, or resinous substances have never been mixed together for the manufacturing of gas, he has but little knowledge of the history of that art. The name of *hydro-carbons* with which he labels these different articles, has not been enlisted into the ranks of the chemical nomenclature, and, we apprehend, will not be received as a volunteer. The last article upon the list of compounds to be used is scarcely made with a view to economy. The chemist would not wish to convert turpentine into rosin and spirits, for the sake of combining them together again, for the manufacture of gas. It appears, however, according to the chemistry of this specification, that rosin is to be added to

spirits of turpentine in order to convert oxide of carbon into carbonic acid. We wish very much to see the rationale of this process, as, according to our philosophy, carbonic acid would be more likely to become oxide of carbon, by heating it in company with rosin, than the oxide of carbon to undergo the change above designated.

As regards the rendering the gas portable, the information given, is most meager, or rather there is no information whatever afforded; as the portable gas company of London knew, before they commenced their operations, that gas "when compressed by a peculiar process, into copper recipients, with valves, may be made portable, and applied to all uses where light is essential."

Specification of a patent for an improvement in Carriages and Wagons intended to travel upon Rail-roads. Granted to William Howard, *Esq. Civil Engineer, Baltimore, Maryland, April* 23, 1831. (*With a Copperplate.*)

Be it known, that I, Wm. Howard, of the city of Baltimore, and state of Maryland, have invented a new and useful improvement in carriages and wagons intended to travel upon rail-roads, by means of which the flanches of the carriage or wagon wheels, are prevented from impinging on the rails, when these last vary from a right line in their direction, or, in other words, when there happen to be curves in the location of the rail-road, so that the friction of the flanch against such curved rail, is entirely saved; or, if the flanch should occasionally touch the rails, is so much reduced as to afford no material additional resistance. The contrivance, mode, or invention, by which this most desirable result is obtained, is specified in the following words, which contain a full and exact description of the construction and operation of the said machine as improved by me; and which is also illustrated by the accompanying drawing, which is made a part of this specification.

I employ two wheels, placed at a convenient distance in front of the carriage, or wagon, which I call *governor wheels*, and whose axis of rotation is always kept parallel to the axis of the fore wheels by a frame constructed for the purpose. Each of these wheels is composed of two parts, acting separately and distinct from each other—that is to say—the flanch, and the tread, or bearing part of the wheel. The bearing part of the governor wheel is made to revolve upon the axle, while the flanch is made fast to the same axle. The axle of the governor wheel is divided into two parts, on the inner ends of each of which is placed a bevel cog wheel, which two bevel cog wheels work into a third, placed on the side next the fore axle of the wagon wheels, and parallel to it; so that while one half of the governor wheel axle turns one way, the other half turns in the opposite direction. The three bevel wheels here mentioned are supported in a convenient frame, which also keeps the two parts of the governor wheel axle revolving on the same right line; all which is represented in Fig. 3. of the drawing. The centre bevel wheel,

which effects a change of direction in the opposite parts of the governor wheel axle, moves upon an axle, which extends to, and under, the fore axle of the wagon wheels, and on the end of which is an endless screw. This screw works the end of one arm of a horizontal lever provided with teeth for the purpose, whose fulcrum is in a frame under the axle of the fore wheels and near one of the hubs, and whose other arm, which is bent horizontally at right angles with the first, is connected with and acts upon a horizontal bar, or arm, fastened to the axle of the hind wheels, as represented in figures *one* and *two* of the drawing. The wheels of the wagon revolve upon their respective axles, and the fore and hind axles, besides the usual coupling bar, are so connected, as that the axles may always be in the position of the radii of the curve on which they may be moving, according to the specification, or on the principle, of a patent heretofore obtained by me, for an improvement in rail-way carriages.

Now it is plainly to be seen that the carriage, or wagon, with its governor wheel, when travelling on a straight rail-way, will not have the flanches of any of the wheels to impinge against the rails. On arriving at a curve, however, the flanch of the governor wheel immediately comes in contact with the outer rail, and the friction there, causes it to turn round, together with the bevel wheel attached to it. The second, or intermediate, bevel wheel, is then set in motion, and the endless screw at the end of its axle, moves the lever that is connected with the bar from the hind axle; which, of course, changes the direction of that axle, and in so doing changes also, by the peculiar coupling aforesaid, the direction of the fore axle; and both the fore and hind axles are thus, by the friction of the flanch of the goveenor wheel upon the rail, brought into the position of radii of the curve upon which the carriage, or wagon, is then travelling, without the flanches of the main wagon or carriage wheels coming in contact with the rails.

The invention and improvement here specified may be applied at once to the fore wheels of the carriage, or wagon; which would then be governor wheels in their construction and mode of operation.

What I claim as new, and as my own invention and discovery, in the above described machine, and for the use of which I ask an exclusive privilege, is the separation and distinct action of the flanch, and the tread or bearing part of wheels to be used on rail-roads; and I also claim as my own, and as new and original, the particular combination by which the effect is produced, as described, and set forth in the above specification.

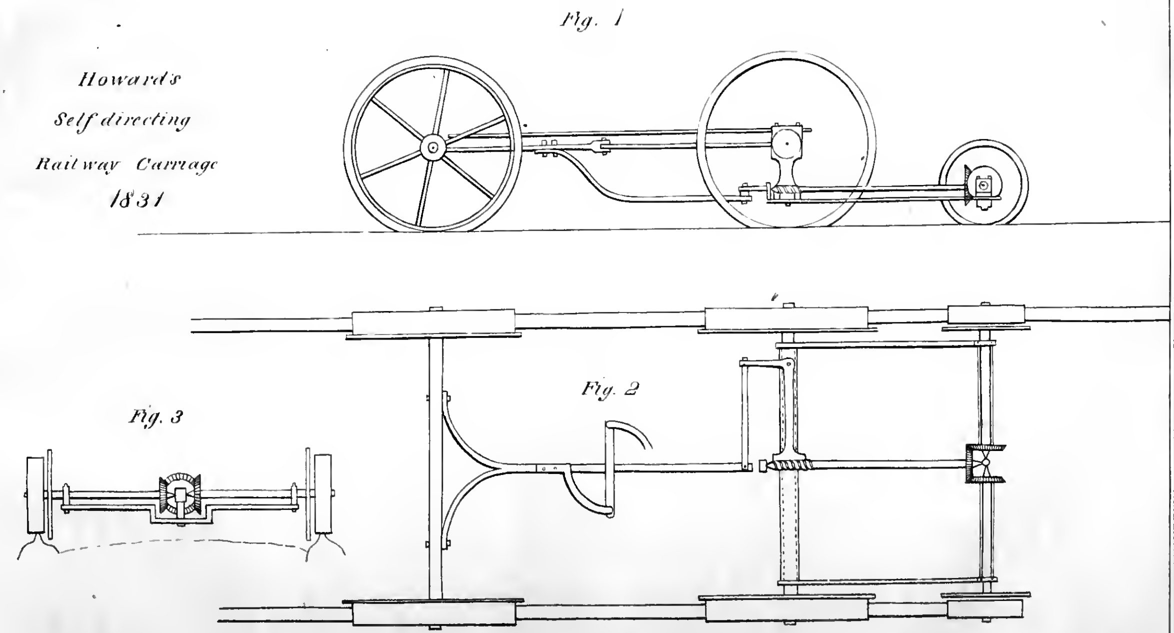
WM. HOWARD.

Explanation of the Drawing.

Figure 1, represents a side view of the carriage. In this, every part of the carriage that is not peculiar to the present invention, and which would interfere with its representation, is omitted.

Figure 2, is a plan of the carriage. In this, the main coupling bar between the axles, seen in Fig. 1, is omitted; and the fore axle is

Howard's
Self directing
Railway Carriage
1831



represented by the dotted line. This arrangement permits the endless screw and the levers that effect a change in the direction of the axles, to be seen.

Figure 3, is a front view of the governor wheels, showing the manner in which the axle is divided, the bevel wheels, and the separation of the flanch and tread of the governor wheels.

ENGLISH PATENTS.

Specification of a Patent granted to CHARLES DEROSNE, *of Leicester Square, in the county of Middlesex, Gentleman, for certain improvements in extracting Sugar or Sirop from Cane-Juice and other substances.—Dated 29th Nov.* 1830.

To all whom these presents shall come, &c. &c.—*Now know ye,* that in compliance with the said proviso, I, the said Charles Derosne, do hereby describe the manner in which the said invention is to be performed, by the following description thereof, (that is to say:)—

The invention consists in a means of discolouring sirops of every description, by means of charcoal produced by the distillation of bituminous schistus alone, or mixed with animal charcoal, and even of animal charcoal alone. Whatever sort of charcoal it may be, it must be disposed on beds very thick, on a filter of any suitable form. The filter of itself has nothing particular, and does not form the object of the patent, because it is already known and used for other purposes, but till now it has not been employed for discolouring sirops. To obtain this discolouration, I put the charcoal in a case, in which I place at a distance of about an inch from the bottom a metallic diaphragm pierced with a great number of holes; I then place upon this diaphragm a clear and coarse linen or woollen cloth, which exactly covers it; I then place upon this cloth a bed of charcoal of bituminous schistus alone, or mixed with animal charcoal, or animal charcoal alone. Whatever it may be, this charcoal ought to be in a state of division, in order that it may be well penetrated with the sirop which is intended to be filtered. Charcoal in fine powder would not be penetrated by the sirop. It has been found that the charcoal reduced to the size of fine gunpowder is very fit for this operation; if the grain is too large, the filtration would be operated too rapidly. I lightly press the charcoal, and then again place new beds of the same charcoal, which should likewise be pressed till it has come up to the height of fifteen or sixteen inches. It may be made higher if found necessary, or it may be less, but the discolouring effect will be always in proportion to the thickness of the bed of charcoal. When the charcoal is disposed to the proper thickness, it is to be covered with another metallic diaphragm, pierced likewise with holes, upon which is spread another clear linen cloth; it is upon this cloth on which is poured the sirop which is destined to be discoloured. The sirop ought then to form a bed of several inches

thick, from four to eight, although there is no precise rule. For operating well in the filtration of sirops, the sirop ought to be clear before pouring it upon the filter, and ought to have undergone a first filtration by the known means, the point to be obtained by the filtration through the thick beds of charcoal is only the discolouration of sirops. The sirop to be filtered ought not to pass over the consistence, which is produced by two-thirds of sugar and one-third of water; but it may be filtered at any less degree of consistency according to the result required. When the sirop is hot the filtration operates a great deal more rapidly. In operating on a great scale, a reservoir filled with sirop can furnish several filters at a time by means of cock-balls placed in each filter. The first portion of sirop which passes through the filter is always the most discoloured, and by the time the colouring part combines itself with the charcoal, the effect of the last portion becomes less sensible. The portion of sirops which preserves a part of its colour after its filtration, can be passed again upon another bed of charcoal in another filter, and by this means it may be obtained in a great degree of purification. Whatever the charcoal used, it is desirable to mix the charcoal with about one-sixth part of its weight of water before putting it in the filter. The place of that water is occupied by the sirop which penetrates the beds of charcoal, and then the water comes the first; it has a disagreeable and salted taste when the animal charcoal is used, the water after that comes mixed with a portion of sirop, and soon after it is displaced by the pure sirop.

When the charcoal has been deprived of its colouring effect, pour water on the filter for dissolving or displacing the sirop which is mixed with the charcoal, the sirop then comes pure first, and after that mixed with more or less water, using as little as possible of water, it is convenient to suspend occasionally the effusion of water on the upper part of the filter, and to shut its cock. The sirop being heavier than the water, gains the bottom of the filter, and runs first. The sirops made with raw sugar by this process can be made as clear as water. The molasses are deprived of their bad taste, and are converted into a good kind of sirop of a clear and yellow colour. The sirops from which it is desired to separate colouring matter can be obtained directly from the juice of cane, or of beetroot, or from the saccharine matter produced by the action of sulphuric acid upon the farinaceous matters before these juices or liquids have been baked for extracting the sugar. The sirop may likewise be produced by the solution of all kinds of sugar, and of the products of inferior quality, which are obtained in sugar refining under the name of "bastards," and other sugars. The purpose of producing of sirops may be to sell them in such a state for the ordinary consumption, or to bake them for making sugar whiter than is obtained by the common process, or these whitened sirops may be used for discolouring the refined sugar, in making them filter through the loaves for replacing the use of the earth and water. The object of the invention being to obtain discoloured sirops by the means above

described, this discolouration of sirops is always proportionate to their primitive colouration, and to the quantity of charcoal which is used. The carbonization of bituminous schistus has nothing particular; it is produced in close vessels, as is done for producing animal charcoal, only it is convenient, before the carbonization, to separate from the bituminous schistus the sulphurets of iron which are mixed with it. Instead of using the schistus, or animal charcoal of the size of gunpowder, it can be reduced to a powder still more fine, mixed with sand; in this state a given quantity of charcoal discolours better than powdered less fine, but the filtration is slower and more difficult to be regulated. After having tried this first method, I have given the preference to the other mode, but both of them are the object of the patent.

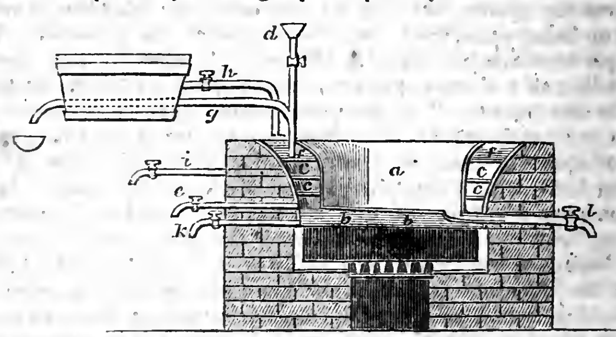
In witness whereof, &c.

Patent granted to WILLIAM SHAND, *of the Burn, in Kincardineshire, Esq. for certain improvements in evaporating Sugar.*

THE object of this invention is to evaporate sirop and other organic matters rapidly, without producing that carbonization or charring which invariably attends the direct application of fire to the evaporating vessel. Every colonial planter knows that rapidity of evaporation, at a moderate temperature, is highly conducive to the amelioration of the sugar, not only by preventing charring, which improves the quality, but also by increasing the quantity, more of the sirop being granulated, and less converted into molasses. The principle by which this object is effected, is by applying heat through the medium of a volatile substance, which, while it imparts sufficient heat for the purpose of evaporation, cannot char or discolour the matter to be evaporated. The substance employed for this purpose is oil or spirits of turpentine, which boils at a temperature not exceeding 320° Fah.; it is applied by means of a double copper vessel. as shown by a section through the centre thereof in the accompanying drawing: *a* is the evaporator for receiving the sirop or other liquid to be evaporated, and *b b* is the outer copper into which the inner one is fixed, leaving an intermediate space at the sides and bottom. Spirits of turpentine is poured into this space through the vertical tube and funnel, *d*, until it is in contact with the bottom only of the inner copper, any excess above this quantity being withdrawn by the trial cock, *e*. The object of this arrangement is, that the boiling oil may be directly applied to the *bottom* of the inner copper, while its vapour plays round its sides. It is essential that the hot oil should actually touch the bottom of the inner copper, since the heat communicated by the vapour alone is insufficient to maintain rapid ebullition, owing to the small quantity of latent heat which it contains, comparatively with that of aqueous vapour, the ratio being 175° to 960°; but provision must be made to prevent the escape of the vapour, or any portion of oil, and the mode of effecting this object, constitutes the peculiar advantage of this evapo-

rator. This arrangement consists in a channel, *c c c c*, which commences at a given height above the bottom of the inner copper, passes around its sides, and terminates under the water gutter, *f f*, the bottom of which completes the upper part of the channel. The vapour is thus made to circulate round the sides of the copper, giving out its heat to, and being partially condensed by, the evaporating liquid, and subsequently being completely condensed, by a supply of water introduced for that purpose into the water gutter, *f f*, above mentioned. Since by extending the lower surfaces of the water gutter over the vapours, any degree of controlling power may be exercised, there is no risk of the oleaginous vapour escaping beyond this point; but if additional security were required, it would be easy to apply a subsidiary condenser, by conducting the tube, *g*, which communicates with the circular channel, *c c c c*, through a trough, or other convenient vessel of water, placed near the side of the evaporator. The water of condensation is conveyed to the gutter, *f f*, by means of the pipe, *h*, and it is removed, when it becomes hot, through the pipe and stop-cock, *i*. The pipe and stop-cock, *k*, is for drawing off the oil when necessary, and a similar pipe and stop-cock, *l*, is intended to draw off the sirop from the evaporating vessel.

The foregoing explanation refers in particular to the manufacture of sugar, because it is conceived that its application to this branch of industry, both in our colonies and in refining, will be found the most important; but the principle is obviously applicable to other purposes, as, for example, in procuring a pure spirit by distillation.



Patent granted to JAMES COLLIER, *of Newman street, Oxford street, in the Parish of St. Mary-le-bone, Civil Engineer; and* HENRY PINKUS, *of Thayer street, Manchester Square, in the county of Middlesex, Gentleman, for an improved method and apparatus for generating Gas for Illumination.—Dated April 5, 1830.*

THE material from which the gas is to be generated consists of a proportion of one cwt. of rosin, pitch, or other bitumen, dissolved by the ordinary means, or a similar quantity of Stockholm or Arch-

angel tar, which, being heated to a temperature of from 150° to 200° of Fah., is mixed with five to seven per cent. by weight of sugar, molasses, or other similar combustible, affording an excess of carbon. The mixture is then to be agitated till all effervescence ceases, and is then ready to be used for producing gas in the way to be described.

A cylindrical retort, divided longitudinally into three compartments, is placed in a common coke furnace, its periphery resting on friction rollers affixed to the latter. A pipe or funnel proceeds horizontally from the back of the retort, and is furnished with an elbow and stuffing box, the former dripping into a hydraulic joint, and communicating with a condenser below it. Above the retort, and parallel with it, are three generators, composed of as many pipes, which unite in one before entering at the front of the retort, and furnished with proper feed cocks. A feeding valve and governor is connected with the condenser, and communicate with the supply cocks by means of a lever.

The patentees observe, that the surfaces of the compartments, on to which the heated material is to be injected, should be covered with fragments of bricks or coke. The retort being heated to a bright cherry red, the material may be passed into the generators by means of a force pump, or by a column of the fluid of convenient length, according to the required pressure necessary to keep the generators full. When the fluid has become sufficiently heated, vent must be given at the feed cock, when it will, by its expansive force, flash off into the retort in small streams or sprays, and will fall nearly equal over the red-hot surface, and will consequently be more effectually and quickly decomposed than by the common mode of letting the fluid fall on one part of the retort, which would soon become cooled down to a black heat, and cease to decompose the material, whilst the remaining part of the retort would frequently acquire so intense a heat as to deposite much carbon. The material having absorbed caloric in its passage through the generators, will require proportionably less heat to decompose it in the retort.

By the common method of using the resinous bitumen, much inconvenience has arisen owing to the detrimental effects produced on the metal of the retorts by the development of its oxygen, and the consequent formation of acids in the retort. To obviate these injurious effects, sugar or molasses, or other similar combustibles, affording an excess of carbon, is combined with the bitumen as before described. When this compound material is subjected to a red heat, and oxygen is developed, part of the latter will unite with the excess of carbon to form carbonic acid gas, (which may be removed by purification,) and a part will unite with hydrogen to form water, which will be deposited in the condenser, and may be separated from the resinous matter by decantation.

Another method is proposed for neutralizing such effects, and consists in admitting into the retort when in action, ammoniacal gas, or hydrogen gas in excess; part of the oxygen will then unite with the hydrogen gas, or hydrogen of the ammonia, and water will be deposited as before, some nitrogen from the ammonia will appear, the

metal of the retort will thus be preserved, and their power to decompose be less impaired.

The advantages contemplated in the adoption of the revolving retort for this purpose, are stated to be that, first, in a given capacity for generating, there is considerably less metal to be heated; secondly, much smaller ovens or furnaces will be required, and there will be consequently less radiating surface, a saving in fuel, and fewer condensing vessels required; but we do not confine ourselves to any particular form of retort.

The effects produced in fixed retorts, by oleaginous or carbonacious matter falling on and adhering to one surface, is of such a nature as to diminish the power to decompose and obstruct the absorption of heat; by returning the revolving retort on the friction rollers, fresh surfaces are presented to action, when the previous ones will have time in some measure to recover their former condition.

The advantages contemplated, by the combination of a feed valve with a compensating valve, or a common governor, is the regulating, by the latter, the supply of gas to the burners with more uniform pressure, and preventing the agitation or jumping of the lights caused by the sudden or unequal velocity of the gas issuing from the retort. As the gas issues from the retort it enters the feed valve, lifts one end of the lever, depresses the other, and shuts off the supply to the retort. As the gas becomes exhausted the feed valve becomes depressed, and the other end of the lever rises, opening the supply cock, when more heated material flashes into the retort.

The patentees claim as their improvement, first, the above described method of neutralizing the effects and inconveniences arising from the common manner of using the resinous bitumen, by adding to the bitumen molasses, sugar, or other similar material, which shall unite with the oxygen developed in the retort, and form compounds less detrimental; second, the means of effecting the same object by admitting into the retort, when in action, ammoniacal or hydrogen gases; third, injecting into the retort any material to be decomposed, whether by the action of a force pump, or by the expansibility of heated material; fourth, the method of heating in generators under pressure a material to be decomposed; fifth, the combination of a compensating valve or governor, in conjunction with a feed valve, but disclaiming them when uncombined or separate; and sixth, the application of a finishing purifier, when placed at the outlet valve as described.

Documents relating to the Royal Ordinances of France, (1823 and 1828,) *concerning High Pressure Steam Engines.*

[TRANSLATED FOR THIS JOURNAL.]

(Continued from page 327.)

Circular of the 16*th of July*, 1828, *to the Prefects of Departments, on the subject of the Royal Ordinances, of the* 29*th of October*, 1823, *and the* 17*th of May*, 1828, *concerning High Pressure Steam Engines.*

Sir,—On the 1st of April, 1824, and on the 19th of May, 1825, I had the honour of addressing to you two circulars, accompanied by instructions, relating to the execution of the ordinance of October 29th, 1823, (No. 637, of the Bulletin of Laws, p. 230,) concerning high pressure steam engines, or those in which the elastic force of the steam exceeds two atmospheres. The experience of four years and a half, showed the want of new regulations in relation to high pressure steam engines, and his majesty has issued a new ordinance on this subject, bearing date the 17th of May, last.

The same Board of Engineers of Mines, and of Civil Engineers, which I convened in 1823, to put in execution the ordinance of October 29th, of the same year, and which had prepared the two sets of instructions spoken of above, has drawn up a third set of instructions, for the execution of the ordinance of May 7th, 1828. These instructions were, at my instance, approved on the 12th of this month, by his excellency the Minister of the Interior.

I have the honour to transmit to you — copies of these instructions. They give, in the first place, the rules for the proof pressure to which boilers must be subjected: they point out, next, the manner in which boilers, as well as interior and exterior cylinders, must be proved; they further show the necessity of giving to boilers of rolled copper or iron, sufficient thicknesses, and the manner of determining these thicknesses, observing that much greater thicknesses in proportion to the diameter, should be given to boiler tubes, than to boilers proper; because, being surrounded by the fire, they are more exposed to oxidation. Lastly, the instructions are terminated by some details, as to the manner of proving boilers and boiler tubes.

You will find appended to these instructions: 1st, a table of thicknesses for boilers of rolled or hammered iron; 2nd, a formula and explanations, which relate to this table; 3d, formulæ relating to the proof of boilers, boiler tubes, cylinders and their jackets.

I am satisfied that the table and the formulæ will be found of easy application.

The last ordinance, that of the 7th of May, 1828, is placed at the end of the instructions.

Experiments are yet to be made, to determine exactly, the elastic force of steam at different temperatures, and the dimensions to be given to safety-valves, as well as to determine the value of new devices, which have been proposed, to insure safety; I shall communi-

cate to you the results of these delicate and important experiments, as soon as they are completed.

I must not conclude this communication without recommending again to your attention, and to the superintending care of the Engineers of Mines and Civil works, the operation of the steam engines in your department. These operations involve human life, as well as the prosperity of the mechanic arts; and as the minor details are of importance, and may escape the memory, I beg you, as well as the engineers, to refer to the circulars of the 1st of April, 1824, and the 19th of May, 1825, and to the instructions which accompany them; to examine, again, their contents, and to satisfy yourself that those instructions are conformed to. As a knowledge of the instructions, whch I now transmit to you, is indispensable to the manufacturers of boilers and of high pressure engines, I request you to send copies to both these classes of persons, so that they may profit by the information afforded them, and conform to the directions prescribed.

I hope, further, that you will attend to the execution of the ordinance of the 7th of May, 1828, and of the instructions which I now transmit to you, and request you to advise me of the receipt of the present communication.

I have the honour to be, &c. &c.

(Signed,) Becquey,

Counsellor of State, Director General of Civil Works and Mines.

Third Set of Instructions in relation to the execution of the Royal Ordinances of the 29th of October, 1823, and 7th of May, 1828, concerning High Pressure Steam Engines.

In conformity with the third article of the Royal Ordinance of October 29th, 1823, in relation to high pressure steam engines, the boiler of every engine of this kind must be subjected, in its proof, to a pressure equal to five times the usual working pressure of the engine. This proof pressure is reduced, by the Royal Ordinance of the 7th of May, 1828, to triple the usual working pressure, for boilers made of rolled copper or of wrought iron.

Cast iron boilers will still be required to bear the proof of a quintuple pressure.

This proof pressure has reference to the bursting pressure, which is evidently equal to that produced by the tension of the steam within, diminished by one atmosphere; since the boiler is pressed on the exterior by the atmosphere. This explains why the 4th art. of the Royal Ordinance of the 7th of May, 1828, directs that the tension of the steam under which the engine is ordinarily to work, diminished by one atmosphere, should be assumed as the unit of pressure.

According to the 2nd and 3d articles of the new ordinance, boiler tubes, as well as cylinders and their jackets, will be proved by a pressure referring to the same unit. This proof pressure will be quintuple

the ordinary pressure for generator-tubes and cylinders of cast iron, and only triple for those of copper or wrought iron.

The mark to be affixed, after proving, to boiler tubes and cylinders, will be regulated in the manner set forth, for boilers, in the second set of instructions, in reference to the ordinance of October 29th, 1823.

For example, suppose an engine to be run usually at a pressure of five atmospheres. The boiler, after proving, must be marked five atmospheres. The unit of pressure being five less one, or four atmospheres, this number is to be multiplied by five, if the boiler be of cast iron, or three, if of copper, or of wrought iron, to determine the proof pressure. Thus the mark five, will show that the boiler, if of cast iron, has been subjected to a proof pressure of twenty atmospheres; if of copper or wrought iron, to a proof of twelve atmospheres.

If the boiler be of cast iron, and the boiler tubes of copper, or wrought iron, these latter, although they have been subjected but to a triple pressure, are to be marked five, as well as the boiler which has borne a quintuple pressure.

Manufacturers should not be induced, by the less proof to which boilers of wrought iron, or of copper, will be subjected, to diminish the thickness now in use for such boilers. If any such diminution should be made, the consequences would be of the worst kind, and to prevent this, the first art. of the Royal Ordinance of the 7th of May, 1828, while it reduces the proof, requires such a thickness to be given to the boiler, that the resistance of the metal may not be diminished by the proof.

Experience has shown, that elastic substances, as iron or copper, cannot bear, without injury, a strain nearly equal to that producing their rupture. The same injury would occur, if boilers of those materials were too thin. It is, therefore, essential to give to a boiler such a thickness, as shall enable it to bear three times the pressure to which it is to be subjected, under the hydraulic press. If this were not the case, the proof might injure it, without, perhaps, producing any external appearances of rupture.

Manufacturers, therefore, should make their boilers too thick, rather than too thin, thus avoiding the risk of their giving way, after having stood the proof pressure.

It is proper to observe here, that the 7th article of the Royal Ordinance of October 29, 1823, requires the engineers to examine, at least once a year, every boiler; to ascertain the condition of each, and to induce the condemnation of those, which long use, or accidental deterioration, may have rendered, in their opinion, dangerous. The only means of proving a boiler, is to submit it, anew, to the action of the hydraulic press. It is, therefore, necessary that manufacturers should furnish boilers, which may, at any time, be proved without injury to them.

The thicknesses hitherto given to boilers of wrought iron, have been considered too small for the quintuple proof; they will, however, suit the triple one, and if such dimensions be preserved, boilers may be proved without injury to them.

The proper thickness for a boiler is to be determined, with relation, 1st. to the tenacity of the material to be used, allowing for the injuries to which it may be exposed; 2nd. to the diameter of the boiler; and 3d. to the bursting pressure which the boiler is to withstand. The mode of calculation is as follows: express in inches, and decimal parts of an inch, the interior diameter of the boiler, which is supposed cylindrical, with hemispherical ends, the only proper form for a high pressure boiler; multiply the diameter, thus expressed, by 18, and this product by the interior pressure (in atmospheres) less one; to this product add 1200, and divide the sum by 10,000, the quotient will give in decimal parts of an inch the thickness sought.

Let us suppose, for example, a boiler of which the interior diameter is 30 inches, and the pressure of the steam within, 5 atmospheres, required its thickness. Thirty, multiplied by 18, gives 540; this product multiplied by 5 less one, or 4, becomes 2160; 1200 added to this, gives, for a sum, 3360; this divided by 10,000, which is done by cutting off 4 figures for decimals, gives (.336) 336 thousandth parts of an inch for the thickness required. The thicknesses, given in the table annexed to the present set of instructions, were calculated in this way. It will afford the means of judging whether a boiler is thick enough to be subjected to the proof, the quality of the metal of which the boiler is made being considered separately. This table includes a variety of cases, and any thickness not found there, may be calculated by the method explained above—the formula for expressing which, will be found appended to the table.

High pressure boilers should never have a less thickness than .18 ($\frac{3}{16}$ths) of an inch; but while an insufficient thickness is to be guarded against, the opposite extreme, viz. giving too great a thickness, is equally to be avoided. Experience shows, that boilers, when very thick, are affected greatly by the action of the fire. Practical men give .56 ($\frac{9}{16}$ths) of an inch as the maximum thickness. This limit restricts the dimensions of boilers intended to supply very high steam; for example, the table appended to these instructions, shows that a boiler, bearing the stamp of eight atmospheres, cannot have a diameter greater than between 34 and 36 inches.

The preceding remarks show, that no boiler can be licensed, which is not of the thickness required by the number representing the pressure within, and by its diameter, even when such a thickness could not be given, without going beyond the prescribed *maximum*. In such a case, a mark of a lower grade must be affixed, and if the manufacturer require a boiler of the proof first intended, he must provide one of a less diameter. It must be observed, that the method, just given, for determining thicknesses, does not apply to boiler tubes. These tubes have a much greater proportional thickness given to them than to boilers, since, from their position, they are more exposed to deterioration.

If the boiler is to be made of laminated copper, the table, or formula, may still be used to determine its thickness. Manufacturers are not in the habit of giving to copper boilers thicknesses

greater than those of iron boilers, of the same diameters; because, although rolled iron is more tenacious than copper, the qualities of different sheets, and even of different parts of the same sheet, are very variable, which is not the case with copper. If, however, the copper is not of good quality, one or two-tenths of the thickness given by the table, should be added to the numbers there found, for the thickness of the boiler.

The present instructions may be usefully concluded by some details upon the method of proving boilers by the hydraulic press, or forcing pump.

In proving boilers, their safety-valves should be loaded with the requisite weights; in the case of boiler tubes or cylinders, the valve of the hydraulic press must be loaded.

The requisite weight will be found as follows:

Express in inches and decimal parts of an inch, the diameter of the valve; square this number, that is, multiply it by itself. Multiply this square by 1178, and divide the product by 100, the quotient will be the number of pounds, and decimals of a pound, with which the valve is to be loaded for each atmosphere. The weight, thus found, multiplied by the required number of atmospheres of pressure, will give the proof weight. As an example, take a valve of 1.5 inches in diameter. Squaring this number gives 2.25; multiplying the square by 1178, we have 2650.50; dividing this product by 100, (removing the decimal point two places to the left, gives 26.5050 lbs. for the load upon the valve, which will balance a bursting pressure of one atmosphere.

If the proof required is twelve atmospheres, the number just found should be multiplied by 12; if 20 atmospheres, by 20. Let us suppose the latter case, the valve must then be loaded with a weight of 530.1 lbs.

In order to apply this weight by the intervention of a lever, the number just found must be multiplied by the short arm* of the lever, and the product divided by the long arm, each being expressed in inches. For example, suppose the short arm of the lever to be 2 inches, the long arm 15 inches; 530.1 must, in such a case, be multiplied by 2, and the product divided by 15; this quotient, 70.68 lbs. is the weight to be applied at the end of the long arm of the lever. If the long arm were ten times the length of the short arm of the lever, the weight to be applied would be 53.01 lbs. one-tenth of the direct weight. Such a ratio has been adopted by the principal mechanicians of Paris; it shortens calculations: its adoption in all the manufactories of steam engines, and of hydraulic presses, is recommended.

The numerical operations, which have been described, are expressed by algebraic formulæ, in the appendix to these instructions.

In conclusion, it is to be observed, that before the proof is begun, the engineer should ascertain that the valves are well made, and carefully fitted.

When a valve is defective the water is forced out in particular

* The short arm of the lever, is the distance from its fulcrum to the point where the lever acts upon the valve; the long arm, the distance from the fulcrum to the point of application of the weight.

parts of the periphery, before the required pressure has been reached; there can be no certainty that the proof pressure has been applied, until the valve rising suddenly allows the water to escape at every point of its circumference.

Table of thicknesses to be given to Wrought Iron Boilers, for High Pressure Engines.

Diameters of Boilers.	Thicknesses in Decimals of an inch.						
	Working pressures in atmospheres.						
Inches.	2	3	4	5	6	7	8
20	.156	.192	.228	.264	.300	.336	.372
22	.160	.199	.239	.278	.318	.358	.397
24	.163	.206	.250	.293	.336	.379	.422
26	.167	.214	.260	.307	.354	.401	.448
28	.170	.221	.271	.322	.372	.422	.473
30	.174	.228	.282	.336	.390	.444	.498
32	.178	.235	.293	.350	.408	.466	.523
34	.181	.242	.304	.365	.426	.487	.548
36	.185	.250	.314	.379	.444	.509	.574
38	.188	.257	.325	.394	.462	.530	.599
40	.192	.264	.336	.408	.480	.552	.624

Formula and Explanatory Remarks referring to the foregoing Table.

The numbers in the first column of the table, are the diameters of the boilers expressed in inches. Above each succeeding column is placed the number denoting the pressure within the boiler in atmospheres, and in each column the thickness to be given to the boiler to withstand such a pressure, is stated in decimal parts of an inch.

For example, if we required the thickness which should be given to a boiler, of 30 inches diameter, to contain steam of 5 atmospheres. In the first column we find 30, and in the column headed 5, on a line with 30, the number expressing the thickness is to be found, viz .336 of an inch, or about $\frac{5}{16}$ths.

The maximum thickness for a boiler being .56 of an inch, ($\frac{9}{16}$,) as has been stated in the preceding instructions, a boiler marked 8 atmospheres must always be of a less diameter than 36 inches. The limit is 34.92 inches. A boiler, therefore, of greater diameter than this, must have a lower mark. For pressures above 8 atmospheres it is evident that the diameters must be decreased as the pressures increase.

The table gives the thicknesses of boilers having the marks of 2, 3, 4, 5, 6, 7, and 8 atmospheres, and having diameters of from 20 to 40 inches inclusive. For pressures and diameters not contained in the table, the thickness may be calculated by the following formula.

$$t=\frac{18d\,(n-1)+1200}{10{,}000}\ *$$

* From this formula, we derive,

$t=.0018d\,(n-1)+.12$, or $d=\dfrac{t-.12}{.0018\,(n-1)}$ (a,) and $n=\dfrac{t-.12}{.0018d}+1$ (b)

In this formula, t represents the thickness sought, d the given diameter expressed in inches, and n the number denoting the working pressure. The coefficient 18 was obtained with reference to the proof required to be sustained by the boiler, and to the relation, deduced from practice, between the pressure of one atmosphere and the tenacity of wrought iron for a given surface.

The number 1200, added to the numerator, being divided by 10,000, expresses a constant thickness of .12 of an inch, given as a minimum thickness for a boiler to contain steam of atmospheric pressure, and added to make up for the loss of tenacity which the material undergoes in bending it, by heating, or by constant wear.

Suppose given $d = 33.2$ inches, and $n = 4\frac{1}{2}$ atmospheres, we shall have

$$t = \frac{18 \times 33.2\,(4.5-1) + 1200}{10{,}000} = \frac{597.6 \times 3.5 + 1200}{10{,}000}$$

$$= \frac{2091.6 + 1200}{10{,}000} = 329.26 \text{ of an inch.}$$

By beginning the table at 2 atmospheres it has been rendered applicable, as far as was necessary, to low-pressure boilers. It was deemed useless to give the calculations for an atmosphere and a half, inasmuch as at this pressure, manufacturers are in the habit of giving to their boilers thicknesses greater in proportion than for higher pressures.

Formula relating to the proof of Boilers, Boiler Tubes, &c.

Let W express the weight with which a valve is to be loaded, w the weight which applied by means of a lever will produce the pressure W, each being expressed in pounds and decimals of a pound. Let d be the diameter of the valve in inches and parts of an inch; n the number denoting the working pressure, L the longer arm of the lever, to which w is attached; l the shorter arm of the same lever; m the relation between the proof pressure and the bursting pressure of the steam under which the engine works. We shall have

The formula a shows for a given pressure, the greatest diameter which can be given to a boiler, without its requiring a thickness greater than that assumed as a maximum.

If we suppose this maximum thickness to be .56 of an inch and the pressure 8 atmospheres, then $t = .56$ and $n = 8$, hence

$$d = \frac{.56 - .12}{.0018\,(8-1)} = \frac{.44}{.0018 \times 7} = \frac{.44}{.126} = 34.92 \text{ inches, the value already}$$

given.

The formula (b) will serve to ascertain the highest working pressure of steam which can be used in a boiler of a given diameter and thickness. For example, let $t = .44$ $d = 39.2$, we shall have

$$n = \frac{.44 - .12}{.0018 \times 39.2} + 1 = \frac{.32}{.7056} + .1 = 4.5 + 1 = 5.5$$

The supposed boiler cannot bear a higher mark that $5\frac{1}{2}$ atmospheres.

$$W=\frac{d^2\times 1178\ (n-1)\ m}{100},\quad \text{and}\quad w=\frac{d^2\times 1178\ (n-1)\ m}{100}\times\frac{l}{L}(^*)$$

If the boiler be of cast iron, m will correspond to five times the bursting pressure, or $m=5$; if of wrought iron, $m=3$.

Let us take a cast iron boiler as an example, then $m=5$. Also, let us suppose $d=1.5$, $n=4$, $L=24$, and $l=2$, we shall have for the direct load of the valve,

$$W=\frac{1.5\times 1.5\times 1178\ (4-1)\ 5}{100}=\frac{2.25\times 1178\times 15}{100}=397.57 \text{ lbs.}$$

And for the weight to be applied to the lever

$$w=397.57\times\frac{2}{24}=33.13 \text{ lbs.}$$

If the boiler were of wrought iron, the other data remaining the same, $m=3$, we should then have, $W=238.55$ lbs, and $w=19.88$ lbs.

(Signed,) BECQUEY,
Counsellor of State, &c.

Approved, &c.
Paris, July 12th, 1828.

The Results of Machinery.

(Continued from page 349.)

The price of *bread*—the great staff of life—has thus we see been reduced *a full half* by the substitution of wind and water-mills for the hand-mill; but even this benefit, inestimable as it is, is exceeded in degree by what has been effected by machinery in regard to other articles more or less essential to human subsistence and comfort.

The same quantity of *coal*, which can now be obtained by the aid of machinery for eighteen pence, or one day's wages of the worst paid labourer, could not be obtained without it for a whole year's wages—(p. 347.)—that is to say, it would take a man with a mattock and shovel three hundred and thirteen working days to obtain fuel sufficient for the consumption of seven! It may, in fact, with greater truth be affirmed, that without machinery, coals could not be procured at all in any considerable quantity at any price; for of what use would it be to dig pits were there neither windlass, nor horse-gin, nor steam engine to keep them dry and raise the coals to the surface?†

* In the preceding remarks, the lever is considered as destitute of weight, or, which amounts to the same thing, is supposed to be balanced upon its fulcrum by a suitable counterpoise. Although the levers in practice are not thus arranged, the allowance for their weight is generally neglected. If it were deemed necessary, in any case, to consider the pressure upon the valve by the weight of the arm of the lever, it might be done by subtracting half that weight from the load at the extremity of the arm, as shown by the above formula. Calling s this weight, and w' the constant load, we shall have, if not exactly, at least nearly enough for practice, $w'=w-\frac{1}{2}s$.

† "The sufferings produced by a want of coal cannot be estimated by those who have abundance. In Normandy, at the present day, such is the scarcity of

"In all mining operations, conducted as they are in modern times, and in our own country, we must either go without the article produced, whether coal, or iron, or lead, or tin, if the machines were abolished—or we must employ human labour, in works the most painful, at a price which would not only render existence unbearable, but destroy it altogether. The people, in that case, would be in the condition of the unhappy natives of South America, when the Spaniards resolved to get gold at any cost of human suffering. The Spaniards had no machines but pickaxes and spades to put in the hands of the poor Indians. They compelled them to labour incessantly with these, and half the people were destroyed. Without machinery, in places where people can obtain even valuable ore for nothing, the collection and preparation of metals is hardly worth the labour. Mungo Parke describes the sad condition of the Africans who were always washing gold-dust;—and we have seen in Derbyshire a poor man separating small particles of lead from the soft stone, (gypsum,) of that country, and unable to earn a shilling a-day by the process. A man of capital erects lead-works, and in a year or two obtains an adequate profit, and employs many labourers.

Water is equally necessary with bread and fuel to human existence; but it is, in most parts of England, to be had in such abundance, and at so cheap a rate, that the procuring of it seldom costs even the very poorest a thought. But let us take away machinery, and see what would then be the result.

"In some cities of Spain, where the people understand very little about machinery, water, at particular periods of the year, is as dear as wine; and the labouring classes are consequently in a most miserable condition. In London, on the contrary, water is so plentiful, that 29,000,000 of gallons are daily supplied to the inhabitants; which quantity, distributed to about 125,000 houses and other buildings, is at the rate of above 200 gallons every day to each house. To many of the houses this water is, by the aid of machinery, not only delivered to the kitchens and wash-houses on the ground floors, where it is most wanted, but is sent up to the very tops of the houses, to save even the comparatively little labour of carrying it from the bottom. All this is done at an average cost to each house of about two-pence a-day; which is less price than the labour of an able-bodied man would be worth to carry a single bucket from a spring half a mile from his own dwelling.

"And how did the inhabitants of London set about getting this great supply of water? How did they get a sufficient quantity, not only to use as much as they please for drinking, for cooking, and for washing, but obtained such an abundance, that the poorest man can afford to throw it away as if it cost nothing, into the channels which

wood, that persons engaged in various works of hand—as lace-making by the pillow—absolutely sit up through the winter nights in the barns of the farmers, where cattle are littered down, that they may be kept warm by the animal heat which is around them. They sleep in the day, and are warmed by being in the same out-house with cows and horses at night; and thus they work under every disadvantage because fuel is scarce and very dear."

are also provided for carrying it off, and thus to free his own room or house from every impurity; and by so doing to render this vast place one of the most healthful cities in the world? They set about doing this great work by machinery; and they began to do it when the value of machinery in other things was not so well understood as it is now. As long ago as the year 1236, when a great want of water was felt in London, the little springs being blocked up and covered over by buildings, the ruling men of the city caused water to be brought from Tyburn, which was then a distant village, by means of pipes; and they laid a tax upon particular branches of trade, to pay the expense of this great blessing to all. In succeeding times more pipes and conduits, that is, more machinery, was established for the same good purpose; and two centuries afterwards, king Henry the Sixth gave his aid to the same sort of works, in granting particular advantages in obtaining lead for making the pipes. The reason for this aid to such works was, as the royal decree set forth, that they were 'for the common utility and decency of all the city, and *for the universal advantage;*' and a very true reason this was. As this great town more and more increased, more water-works were found necessary; till at last in the reign of James the First, which was nearly 200 years after that of Henry the Sixth, a most ingenious and enterprising man, and a great benefactor to his country, Hugh Myddleton, undertook to bring a river of pure water above 38 miles out of its natural course for the supply of London. He persevered in this immense undertaking, in spite of every difficulty, till he at last accomplished that great good which he had proposed, of bringing wholesome water to every man's door. At the present time the New River, which was the work of Hugh Myddleton, supplies 13,000,000 of gallons of water every day; and though the original projector was ruined by the undertaking, in consequence of the difficulty which he had in procuring proper support, such is now the general advantage of the benefit which he procured for his fellow-citizens, and so desirable are the people to possess that advantage, that a share in the New River Company, which was at first sold at £100, is now worth £15,000.

"Before the people of London had water brought to their own doors, and even into their very houses, and into every room of their houses where it is desirable to bring it, they were obliged to send for this great article of life—first, to the few springs which were found in the city and its neighbourhood, and, secondly, to the conduits and fountains, which were imperfect mechanical contrivances for bringing it. The service pipes to each house are more perfect mechanical contrivances; but they could not have been rendered so perfect without engines, which force the water above the level of the source from which it is taken. When the inhabitants brought their water from the springs and conduits there was a great deal of human labour employed; and as in every large community there are always people ready to perform labour for money, many persons obtained a living by carrying water. When the New River had been dug, and the pipes had been laid down, and the engines had

been set up, it is perfectly clear that there would have been no further need for these water carriers. When the people of London could obtain 200 gallons of water for two pence, they would not employ a man to fetch a single bucket from the river or the fountain at the same price. They would not, for the mere love of employing human labour directly, continue to buy an article very dear, which, by mechanical aid, they could buy very cheap. If they had resolved, from any mistaken notions about machinery, to continue to employ the water-carriers, they must have been contented with 1 gallon of water a-day instead of 200 gallons. Or if they had consumed a larger quantity, and continued to pay the price of bringing it to them by hand, they must have denied themselves other necessaries and comforts. They must have gone without a certain portion of food, or clothing, or fuel, which they are now enabled to obtain by the saving in the article of water. To have had for each house 200 gallons of water, and in having this 200 gallons of water, to have had the cleanliness and health which result from its use, would have been utterly impossible. At two pence a gallon, which would not have been a large price considering the distances to which it must have been carried, the same supply of water would have cost about £9,000,000 sterling a-year, and would have employed, at the wages of two shillings a-day, more than one-half of all the present inhabitants of London, or 800,000 people, that is, about four times the number of able-bodied men altogether contained in the metropolis. Such a supply, therefore, would have been utterly out of the question. To have supplied 1 gallon instead of 200 gallons to each house at the same rate of wages, would have required the labour of 12,000 men. It is evident that even this number could not have been employed in such an office; because had there been no means of supplying London with water but the means of human hands, London could not have increased to one-twentieth of its present size;—there would not have been one-twentieth part of the population to have been supplied—and therefore 600 water-carriers would have been an ample proportion to this population."

The example just quoted is the more deserving of attention that among the instances of popular absurdity which have disgraced the year 1830, there has been actually one of a number of water-carriers combining to prevent, by intimidation, the extension to the city of Exeter of the same benefit from water-supplying machinery, which have been enjoyed, for centuries past, by the inhabitants of the metropolis.

The author next invites the attention of his readers to the influence of machinery in reducing the price of *clothing*. His first example is drawn from the manufacture of cotton. At the time Arkwright introduced spinning by machinery, the price of a particular sort of cotton yarn, (much used in the manufacture of calico,) was thirty-eight shillings a pound—now it costs only between three and four shillings; cottons sold then at six shillings a yard—now they average scarcely sixpence. The total annual value of the cotton manufacture did not then exceed £200,000; at present it amounts to

£36,000,000. Of the cotton cloth now made in England, about four hundred millions of yards are retained for home consumption; which, taking the population at twenty-five millions, allows sixteen yards each for every individual; eighty years ago, not one person in thirty had even a single yard to his share. In fact, although cotton stuffs were always cheaper than silk, (which was anciently sold for its weight in gold,) they were still, at the time of Arkwright, so costly as only to be purchased by the most opulent.

"The invention of Arkwright—the substitution of rollers for fingers, changed the commerce of the world. The machinery by which a man, a woman, or even a child, could produce two hundred threads where one was produced before, caused a cheapness of production much greater than that of India, where human labour is scarcely worth any thing. * * * The trade in India cotton goods is hence gone for ever. Not even the caprices of fashion can have an excuse for purchasing the dearer commodity. We make it cheaper and we make it better. The trade in cotton, as it exists in the present day, is the great triumph of human ingenuity. We bring the raw material from the country of the people who grow it, on the other side of our globe; we manufacture it by our machines into articles which we used to buy from them ready made; and taking back those articles to their own markets, encumbered with the cost of transport for fourteen thousand miles, and encumbered also with the taxes which the State has laid upon it in many various ways, we sell it to these very people cheaper than they can produce it themselves, and they buy it, therefore, with eagerness."

* * * * *

"Nor is the creation of employment amongst ourselves by the cheapness of cotton goods produced by machinery, to be considered as a mere change from the labour of India to the labour of England. It is a creation of employment operating just in the same manner as the machinery did for printing books. The Indian, it is true, no longer sends us his calicoes and his coloured stuffs; we make them ourselves. But he sends us forty times the amount of raw cotton that he sent when the machinery was first set up. In 1781 we imported five million pounds of cotton wool. In 1828 we imported two hundred and ten million pounds—enough to make twelve hundred and sixty million yards of cloth—which is about two yards a piece for every human being in the world. The workman on the banks of the Ganges, (the great river of India,) is no longer weaving calicoes for us, in his loom of reeds under the shade of a mango tree; but he is gathering for us forty times as much cotton as he gathered before, and making forty times as much indigo for us to colour it with. The export of cotton has made such a demand upon the Indian power of labour, that even the people of Hindostan, adopting European contrivances, have introduced machinery to pack the cotton. Bishop Heber says, that he was frequently interested by seeing, at Bombay, immense bales of cotton laying on the piers, and the ingenious screw, by which an astonishing quantity is pressed into the canvass bags. The Chinese, on the contrary, from the want of these contrivances, sell their cot-

ton to us at much less profit; for they pack it so loosely that it occupies three times the bulk of the Indian cotton, and the freight costs twelve times the price to which it might be reduced by mechanical skill."

Another striking instance of an important article of apparel, depending almost entirely on machinery for its general introduction, is furnished by the history of the stocking manufacture.

"Before the invention of the first stocking-machine, in the year 1589, by William Lea, a clergyman, none but the very rich wore stockings, and many of the most wealthy went without stockings at all, their hose being sewn together by the tailor, or their legs being covered with bandages of cloth. William Lea made a pair of stockings by the frame in the presence of King James I.; but such was the prejudice of those times, that he could get no encouragement for his invention. His invention was discountenanced, upon the plea that it would deprive the industrious poor of their subsistence. He went to France, where he met with no better success; and died at last of a broken heart. The great then *could* discountenance an invention because its application was limited to themselves. *They* only wore stockings; the poor who made them had none to wear. Stockings were not cheap enough for the poor to wear, and therefore they went without. Of the millions of people now in this country, how few are without stockings! What a miserable exception to the comforts of the rest of the people does it appear to you when you see a beggar in the streets without stockings! You consider such a person to be in the lowest stages of want and suffering. Two centuries ago, not one person in a thousand wore stockings; one century ago, not one person in five hundred wore them; now, not one person in a thousand is without them. Who made this great change in the condition of the people of England, and indeed, of the people of almost all civilized countries? William Lea—who died at Paris of a broken heart. And why did he die of grief and penury? Because the people of his own days were too ignorant to accept the blessings he had prepared for them."

Not content with thus establishing the truth of his general position, by examples drawn from articles of necessity, the author goes on to show some very curious effects of machinery in the production of articles, which, though trifling in themselves, are in such general use, that the want of them would be felt as a severe privation.

"There is an article employed in dress, which is at once so necessary and so beautiful that the highest lady in the land uses it, and yet so cheap, that the poorest peasant's wife is enabled to procure it. The quality of the article is as perfect as art can make it; and yet from the enormous quantities consumed by the great mass of the people, it is made so cheap that the poor can purchase the best kind as well as the rich. It is an article of universal use. United with machinery, many hundreds, and even thousands, are employed in making it. But if the machinery were to stop, and the article were made by human hands alone, it would become so dear that the richest only could afford to use it; and it would become, at the same

time, so rough in its appearance, that those very rich would be ashamed of using it. The article we mean is a pin."

* * * * *

"Needles are not so cheap as pins, because the material of which they are made is more expensive, and the processes cannot be executed so completely by machinery. But without machinery how could that most beautiful article, a *fine* needle, be sold at the rate of six for a penny? As in the case of pins, machinery is at work at the first formation of the material. Without the tilt-hammer, which beats out the bar of steel, first at the rate of ten strokes a minute, and lastly at that of 500, how could that bar be prepared for needle-making at any thing like a reasonable price? In all the processes of needle-making, labour is saved by contrivance and machinery. What human touch would be exquisite enough to make the eye of the finest needle, through which the most delicate silk is with difficulty passed? Needles are made in such large quantites, that it is even important to save the time of the child who lays them all one way when they are completed. Mr. Babbage, who is equally distinguished for his profound science, and his mechanical ingenuity, has described this process as an example of one of the simplest contrivances which can come under the denomination of a tool."

On the Effects of different Arts and Trades on Health and Longevity; abstracted from a work on that subject, relating particularly to the Manufactories of Leeds, in England, written by C. Turner Thackrah.

After a series of interesting remarks and calculations, founded no authentic data, Mr. Thackrah says—

"Taking, then, the mortality at Pickering Lythe as the natural one, there was an excess of 321 deaths in the borough of Leeds during the year 1821. And allowing for the increase of population since that period, we may fairly say that at least 450 persons die annually in the borough of Leeds, from the injurious effects of manufactures, the crowded state of population, and the consequent bad habits of life. We may say that every day of the year is carried to the grave the corpse of an individual whom nature would have long preserved in health and vigour;—every day we see sacrificed to the artificial state of society, one, and sometimes two victims, whom the destinies of nature would have spared. The destruction of 450 persons year by year in the borough of Leeds cannot be considered by any benevolent mind as an insignificant affair. Still less can the impaired health, the lingering ailments, the premature decay, mental and corporeal, of nine-tenths of the survivers, be a subject of indifference. Assuredly an examination into the state of our manufactures has long been demanded, alike by humanity and by science. The object of this paper is to excite public attention to the subject. Myself and my pupils have personally and carefully inspected the

state of the artisans in most kinds of manufacture, examined the agencies believed to be injurious, conversed on the subject with masters, overlookers, and the more intelligent workmen, and obtained many tables illustrating the character of the disorders prevalent in the several kinds of employ. From these sources collectively, I have drawn up statements, which, though avowedly imperfect, must, I conceive, approach to the truth."

Mr. Thackrah then goes into his striking details, dividing, for that purpose, the population into four great classes of operatives, dealers, master-manufacturers and merchants, and professional men; and examining "the atmosphere they breathe—the muscular exercise they take—the posture of the body they maintain—the variations of temperature and humidity to which they are exposed—their diet and habits of life; and finally, in some classes, their state of mind." We will display some of the results in almost a tabular form.

OUT OF DOORS.

"*Butchers*, and the slaughtermen, their wives and their errand-boys, almost all eat fresh-cooked meat at least twice a-day. They are plump and rosy. They are generally, also, cheerful and good-natured. Neither does their bloody occupation, nor their beef-eating, render them savage, as some theorists pretend, and even as the English law presumes. They are not subject to such anxieties as the fluctuations of other trades produce—for meat is always in request; and butchers live comfortably in times as well of general distress as of general prosperity. They are subject to few ailments, and these the result of plethora." Though more free from diseases than other trades, they, however, do not enjoy greater longevity; on the contrary, Mr. T. thinks their lives shorter than those of other men who spend much time in the open air.*

Cattle and horse dealers are generally healthy, except when their habits are intemperate.

* "Butchers, (he says,) in fact live too highly—not too highly for temporary health, but too highly for long life. Is every man gifted at birth with a portion of the pabulum of life, which he cannot increase, but which he may prematurely consume;—in other words, does nature endow us with a vital patrimony, which we may exhaust, not only by profligate indulgence, but even by regular draughts too frequently repeated? Or rather, does not high living, (for I speak not at present of excess or intemperance,)—does not high living produce that plethoric state which gradually leads to disease? I believe the latter. Congestion of blood, affecting chiefly the vessels of the abdomen and head, shortens the lives of numbers who are plump, rosy, and apparently strong. My very intelligent friend, Dr. Murray, of Scarborough," he adds, "concurs in the statement relative to butchers. 'The high living of butchers assuredly leads to plethora and premature dissolution.' He adds—'Thus coal-meters, &c. of London, rarely, if every, attain the age of forty, though men remarkable for muscular bulk and strength. They work most laboriously, perspire immensely, and supply such waste by extraordinary and almost incredible potations of porter, which ultimately, without much positive and actual intemperance, brings on irregularities of the digestive system, structural changes, and death.'"

Fishmongers, though much exposed to the weather, are hardy, temperate, healthy, and long lived.

Cart-drivers, if sufficiently fed and temperate, the same.

Labourers in husbandry, &c. suffer from a deficiency of nourishment.

Brickmakers, with full muscular exercise in the open air, though exposed to vicissitudes of cold and wet, avoid rheumatism and inflammatory diseases, and attain good old age.

Chaise-drivers, postilions, coachmen, guards, &c. from the position of the two former on the saddle, irregular living, &c. and from the want of muscular exercise in the two latter, are subject to gastric disorders, and, finally, apoplexy and palsy, which shorten their lives."

Carpenters, Coopers, Wheelwrights, &c. healthy and long lived.

Smiths, often intemperate, and die comparatively young.

Rope makers and gardeners suffer from their stooping postures.

Paviers, subject to complaints in the loins, increasing with age, but they live long.

IN-DOOR OCCUPATIONS.

Tailors,* notwithstanding their confined atmosphere and bad posture, are not liable to acute diseases, but give way to stomach complaints and consumption. "It is apparent, even from observing only the expression of countenance, the complexion, and the gait, that the functions of the stomach and the heart are greatly impaired, even in those who consider themselves well. We see no plump and rosy tailors; none of fine form and strong muscle. The spine is generally curved: the reduction in the circumference of the chest is not so much as we might expect; the average of our measurements presented 33 to 34 inches, while that of other artisans is about 36. The capacity of the lungs, as evinced by measuring the air thrown out at an expiration, is not less than common: the average of six individuals was $7\frac{2}{3}$ pints. The prejudicial influence of their employ is more insidious than urgent—it undermines rather than destroys life. * * * Of twenty-two of the workmen employed in Leeds, not one had attained the age of sixty; two had passed fifty; and of the rest not more than two had reached forty. We heard of an instance or two of great age; but the individuals had lived chiefly in the country."

Staymakers have their health impaired, but live to a good average.

Milliners, dress-makers, and straw-bonnet-makers, are unhealthy and short lived.

Spinners, cloth-dressers, weavers, &c. &c. are more or less healthy

* On the bent postures, which Mr. T. considers so injurious, we may remark, that a French physiologist has just published a memoir, in proof that the spinal marrow has, properly speaking, no special action upon the circulation distinct from the general action of nervous centres, and that it is not in it that the essential principle, still less the exclusive principle of the circulation resides.

as they have exercise and air. Those exposed to inhale imperceptible particles of dressings, &c., such as frizers, suffer from disease, and are soonest cut off.

Shoemakers are placed in a bad posture:—"Digestion and circulation are so much impaired, that the countenance would mark a shoemaker almost as well as a tailor. We suppose that, from the reduction of perspiration and other evacuations, in this and similar employments, the blood is impure, and consequently the complexion darkened. The secretion of bile is generally unhealthy, and bowel complaints are frequent. The capacity of the lungs, in the individuals examined, we found to average six and one-third, and the circumference of the chest thirty-five inches. In the few shoemakers who live to old age, there is always a remarkable hollow at the base of the breast bone, occasioned by the pressure of the last."

Curriers and leather dressers are very healthy and live to old age.

Saddlers lean much forward and suffer accordingly from headach and indigestion.

Printers, (our worthy co-operators,) "are kept in a confined atmosphere, and generally want exercise. Pressmen, however, have good and varied labour. Compositors are often subject to injury from the types. These, a compound of lead and antimony, emit, when heated, a fume which affects respiration, and are said also to produce partial palsy of the hands. Among the printers, however, of whom we have inquired, care is generally taken to avoid composing till the types are cold, and thus no injury is sustained. The constant application of the eyes to minute objects gradually enfeebles these organs. The standing posture long maintained here, as well as in other occupations, tends to injure the digestive organs. Some printers complain of disorder of the stomach and head; and few appear to enjoy full health. Consumption is frequent. We can scarcely find or hear of any compositor above the age of fifty. In many towns printers are intemperate."

Bookbinders—a healthy employment.

Carvers and gilders look pale and weakly, but their lives are not abbreviated in a marked degree.

Clockmakers, generally healthy and long lived.

Watchmakers, the reverse.

House-servants, in large, smoky towns, unhealthy.

Colliers and well-sinkers, a class by themselves, seldom reach the age of fifty.

EMPLOYMENTS PRODUCING DUST, ODOUR, OR GASEOUS EXHALATIONS.

If from animal substances not injurious; nor from the vapours of wine or spirits.

Tobacco manufacturers do not appear to suffer from the floating poison in their atmosphere.

Snuff-making is more pernicious.

Men in oil-mills, generally healthy.

Brushmakers live to a very great age.

Grooms and hostlers inspire ammoniacal gas, and are robust, healthy, and long lived.

Glue and size boilers, exposed to the most noxious stench, are fresh looking and robust.

Tallow-chandlers, also exposed to offensive animal odour, attain considerable age.*

Tanners, remarkably strong, and exempt from consumption.

Corn-millers, breathing an atmosphere loaded with flour, are pale and sickly: very rarely attain old age.

Maltsters cannot live long, and must leave the trade in middle life.

Tea-men suffer from the dust, especially of green tees; but the injury is not permanent.

Coffee-roasters become asthmatic, and subject to headach and indigestion.

Paper-makers, when aged, cannot endure the effect of the dust from cutting the rags. The author suggests the use of machinery in this process. In the wet, and wear, and tear of the mills, they are not seriously affected, but live long.

Masons are short lived, dying generally before forty. They inhale particles of sand and dust, lift heavy weights, and are too often intemperate.

Miners die prematurely.†

Machine makers "seem to suffer only from the dust they inhale, and the consequent bronchial irritation. The *filers*, (iron,) are almost all unhealthy men, and remarkably short lived."

Founders, (in brass,) suffer from the inhalation of the volatilized metal. In the founding of *yellow* brass, in particular, the evolution of oxide of zinc is very great." They seldom reach forty years.

Copper-smiths "are considerably affected by the fine scales which rise from the imperfectly volatilized metal, and by the fumes of the 'spelter,' or solder of brass." The men are generally unhealthy, suffering from disorders similar to those of the brass founders.

"*Tinplate-workers* are subjected to fumes from muriate of ammonia, and sulphurous exhalations from the coke which they burn. These exhalations, however, appear to be annoying rather than injurious; as the men are tolerably healthy, and live to a considerable age. *Tinners* also are subject only to temporary inconvenience from the fumes of the soldering.

"*Plumbers* are exposed to the volatilized oxide of lead, which rises during the process of 'casting.'" They are sickly in appearance, and short lived.

House-painters are unhealthy, and do not generally attain full age.

*"During the plague in London it was remarked that this class of men suffered much less than others."

†"Last year there was in the village of Arkendale, (in the heart of the mining district,) not less than thirty widows under thirty years of age. The prevalent maladies appear to be affections of the lungs and bowels. Smelting is considered a most fatal occupation. The appearance of the men is haggard in the extreme.

Chemists and druggists, in laboratories are sickly and consumptive.

Potters, affected through the pores of the skin become paralytic, and are remarkably subject to constipation.

Hatters, grocers, bakers, and chimney sweepers, (a droll association,) also suffer through the skin; but though the irritation occasions diseases, they are not, except in the last class, fatal.

Dyers are healthy and long lived.

Brewers are, as a body, far from healthy. "Under a robust and often florid appearance, they conceal chronic diseases of the abdomen, particularly a congested state of the veinous system. When these men are accidentally hurt or wounded, they are more liable than other individuals to severe and dangerous effects."*

Cooks and confectioners "are subjected to considerable heat. Our common cooks are more unhealthy than housemaids. Their digestive organs are frequently disordered, they are subject to headache, and their tempers rendered irritable."

Glass workers are healthy; *glass blowers* often die suddenly.

New Process of Distillation.

We have occasion to call the attention of our readers to what will probably be deemed one of the most curious discoveries that has been effected in the useful arts during the present century,—that of procuring alcohol, or ardent spirit, from fermented paste, such as is commonly used for making baker's bread; in lieu of making an extract of malt or corn, for the especial purpose of raising a vinous fermentation, as now practised by the corn distillers. This important discovery has been made by Mr. Robert Hicks, a gentleman in the medical profession, who, we understand, has just taken out a patent for the invention.

As nearly all vegetable substances capable of undergoing the vinous fermentation are known to give out a certain portion of aroma, in conjunction with the carbonic acid gas evolved by the process, it might have been inferred, *á priori*, that at least a portion of such vapour contained gaseous alcohol. But the discovery of this fact, obvious as it may appear when once announced, has hitherto been overlooked, notwithstanding the profound discoveries which have been made in almost every department of chemical science during the last thirty years. The only doubt we entertained on the question, on hearing of this discovery, was, as to the practicability of obtaining spirit in any quantity worthy of notice, from the vapour of fermented paste, and sufficiently pure for the purposes of the rectifier. Previous to offering any notice of this important invention, therefore, we took the trouble of investigating its nature, and of tasting a sample of the spirit which had been produced from the

* "The ill health of brewers is, however, evidently attributed to their habitual and unnecessary potation of beer. There is no reason to believe them injured by their employ."

condensed vapour given off during the process of baking. The specimen we tasted served at once to satisfy us of the practicability of the process on a large scale. The sample (which appeared to be nearly the strength of proof spirit) was certainly destitute both of that empyreumatic flavour, which might have been in some measure expected from a species of *dry* distillation, like that of the baking process; while it was equally free from any fetid or unpleasant odour, such as would be supposed to result from imperfect fermentation. We should say that the spirit we tasted had a slight acidulous or ether-like quality, by no means unpleasant to the palate, but which may probably be quite got rid of by subsequent rectification. It is needless to state that it was also perfectly free from colouring matter, and apparently applicable to the most delicate purposes of the rectifiers and compounders of British spirits.

In the absence of any drawing or plate to illustrate the invention of Mr. Hicks, we shall endeavour to give such a description of the new baker's oven and distilling apparatus, as may perhaps render the invention intelligible to the majority of our readers.

The body of the oven, instead of being constructed of brick-work, is formed of iron plate, and made of a circular figure, having a coating of brick or tile for receiving the loaves, when prepared of the usual sponge or dough. This oven is supported upon hollow brick-work beneath, with a space round the sides and top, sufficient to allow the play of the flame or heated air from the fire below. About a foot beneath the bottom of the oven is a circular iron plate, of the same diameter with itself, on which rests the grate or fire-chamber, with openings for the ashes to fall through into the ash-pit beneath. This circular platform is affixed to, and made to revolve on, a vertical axis, furnished with a bevel wheel, which communicates with another bevel wheel fixed on the end of a horizontal shaft; the exterior end of which shaft is provided with a winch, to enable the platform to be kept in motion by the hand, or any other moving power that may be judged necessary. The object of applying this machinery is to keep the action of the fire uniformly distributed beneath the bottom and round the sides of the oven. But in addition to this desirable point, we are informed that a very great saving of fuel is effected, as compared with the quantity required to heat an oven of the same capacity by the common brick flues. Indeed, when we take in view the rapid conducting power of metal compared with brick-work, nearly the whole effect of the fuel must be rendered available for the double process of baking and distillation. In order to prevent any escape of the heated air or flame, the edges of the circular platform are bent downwards, and made to work in a narrow trough of water, forming what may be called a water-joint.

From the upper portion of the oven, a large chamber or pipe receives the vapour evolved from the baking process, and carries it onwards through a pipe and worm-tub, or refrigerator, as in the usual process of distillation. This vapour from the bread contains a quantity of carbonic acid gas, combined with the alcohol vapour; but the latter becomes condensed into the *liquid* form; while the

former flies off in the gaseous state, from the recipient containing the spirit.

The upper portion of the oven also contains a most ingenious contrivance for regulating the temperature of the whole process with the utmost precision. An iron tube, containing a quantity of oil, has a thermometer immersed in it, and is so contrived as to lower down into the body of the oven, and to be withdrawn at pleasure; thus preventing the possibility of the oven being overheated sufficiently to scorch the bread, or impart a disagreeable flavour to the spirit. The operative portion of this compound process seems to us to be provided for in a manner so as to leave little, if any thing, to be desired.

The practical application of this important discovery may lead to results which cannot at present be anticipated. Without offering any opinion as to the benefit to the community of the extensive consumption of ardent spirit, there can be no manner of doubt that, if it be a benefit, the more cheaply it can be procured, the greater will be the advantage in an economical point of view. If that which has hitherto been deemed a worthless vapour, can be now converted into a valuable product, as an article of almost universal consumption, the discovery must, at all events, be deemed one of great importance in civil economy, and calculated to enhance, in a very eminent degree, our national reputation for improvements in the several departments of the useful arts. How far the discovery of Mr. Hicks may be found to militate against the interests of persons at present connected with distillation from corn, it is not our business to inquire. Neither is it necessary to investigate the position in which the patentee may stand with regard to the present excise regulations relative to the distillation from grain. But the merits of the discovery can be in nowise prejudged, as a scientific process, by the influence it may exercise on any question of manufacturing speculation. With regard to the influence it may have indirectly upon the agricultural interests of the country, from a considerable diminution of the consumption of grain, we are not enabled at present to form any estimate. It will assuredly tend to diminish the enormous consumption of barley at present required for the use of the corn distillers; but when it is considered that the growth of barley in this country is not adequate to such consumption, and that a considerable sum in specie is annually paid to the foreign agriculturist for the importation of grain, without the smallest return being made as a compensation to our manufacturing interests; it is doubtful whether the English agriculturist would eventually suffer by the general introduction of this invention for saving the consumption of grain in the process of distilling. Another important saving will be effected in the consumption of fuel at present used for distillation, which forms so large a portion of the outlay required in this extensive branch of manufacture. We have heard it stated, (but almost deem it incredible,) that the sponge necessary to form the peck loaf is capable of yielding three ounces, imperial measure, of proof spirit during the operation of baking, and without prolonging the process beyond the ordinary time for baking the quartern loaf. It is also stated, that

the bread baked by this new oven is superior in quality, and more porous in texture, than that baked in the usual way, from the vapours being carried off as fast as they are generated by the new patent oven, while a great portion may be presumed to be again condensed and incorporated with the bread by the old process. The invention in a variety of respects, will be likely to excite no ordinary attention in the public mind, the moment it is reduced to practice. [*Literary Gazette.*

Meteorological Observations for May, 1831.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2, P.M.	Dew point	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches	Inches.				Inches.	
	1	47°	57°	29.45	29.45	44	NW. W.	Moderate.		Cloudy day.
	2	46	62	.45	.45	44	W. W.	do.		Cloudy day.
	3	54	72	.56	.56	46	S. S.	do.		Clear day.
☾	4	58	64	.50	.50	45	W. W.	Blustering.	·2	Rain—Flying clouds.
	5	44	66	.70	.70	42	W. W.	Moderate.		Clear day.
	6	41	64	.83	.90	42	NW. W.	do.		Clear—cloudy.
	7	46	67	.80	.70	42¼	W. S.	do.		Cloudy day.
	8	48	55	.34	.30	49	E. W.	do.	.75	Cl'dy—rain—flying cl'ds.
	9	42	55	.35	.44	33	W. W.	Blustering.		Cloudy—flying clouds.
	10	37	59	.70	.74	38	W. W.	Moderate.		Ice—clear day.
⊗	11	44	73	.85	.90	56	SW. W.	do.		Clear day.
	12	54	78	.95	30.05	58	S. S.	do.		Overcast—clear.
	13	55	76	30.10	.10	59	S. S.	do.		Clear day.
·	14	57	76	.14	.14	51	S. S.	do.		Clear day.
	15	56	74	.14	.14	60	E. E.	do.		Cloudy—clear.
	16	56	73	.04	.01	62	SE. SE.	do.		Drizzle—cloudy.
	17	62	78	29.95	.95	60½	E. SW.	do.		Drizzle—clear.
☽	18	59	80	.90	.90	64½	SE. SE.	do.		Foggy—flying clouds.
	19	62	80	.80	.80	65	SE. SE.	Blustering.	.12	Rain—flying clouds.
	20	64	75	.70	.70	51	SW. W.	Moderate.		Cloudy—clear.
	21	59	74	.80	.80	54	SW. W.	do.	.3	Flying cl'ds—slight shw'r.
	22	57	79	.80	.80	52	S. S.	Blustering.	.2	Clear day—rain in night.
	23	50	76	.80	.80	42	NW. W.	Moderate.		Clear—cloudy.
	24	53	57	.75	.75	48	W. NE.	do.	.2	Cloudy—rain.
	25	54	70	.60	.60	53	W. W.	do.	.30	Cloudy—flying clouds.
	26	54	61	.60	.60	53	W. W.	do.		Clear—hail—rain.
☺	27	51	67	.50	.55	54	W. W.	do.	.7	Clear—shower—clear.
	28	59	77	.62	.70	59	W. W.	do.		Clear day.
	29	60	87	.90	.94	64	W. W.	do.		Clear day.
	30	66	89	.94	.94	63	W. W.	do.		Clear day.
	31	67	92	.94	.95	52	W. W.	do.		Clear day.
	Mean	53.61	71.39	29.76	29.77	52			1.33	In. of rain in the month.

	Thermometer.	Barometer.
Maximum height during the month,	92. on the 31st	30.14 on 14th & 15th.
Minimum do. . . .	37. on the 10th, .	29.30 on the 8th.
Mean do. . . .	62.50 . . .	29.765

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* This and the subsequent numbers are each one too high—56 patents issued this month.

END OF VOL. VII.